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ELECTRICAL REVIEW

ILLUSTRATED.

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A Suit to Declare Forfeit the Property of the Combined Telegraph Companies.

Attorney-General Kirkpatrick began suit against the Western Union Telegraph Company, the Baltimore and Ohio Telegraph Company, and the Baltimore and Ohio Telegraph Company of Pennsylvania for an alleged violation of the constitution and the laws of the State of Pennsylvania. The proceedings is in the nature of a writ of *quo warranto* applied for to the court. The attorney-general sets forth that the Western Union Company on October 5, 1887, in violation of the constitution of Pennsylvania, purchased the entire stock and thereby a controlling interest of the Baltimore and Ohio Telegraph Company; that the Baltimore and Ohio Telegraph Company was a competing line in this State with the Western Union, and that its stock, line and franchise were by reason of the sale forfeited to the State. For the same reasons the attorney-general claims a decree of forfeiture and escheat of the line, property and franchises of the Western Union Company in the State. The attorney-general also claims a forfeiture of the line, franchise and property of the Baltimore and Ohio Telegraph Company of Pennsylvania because of such purchase and consolidation. After reciting the facts the attorney-general suggests that the court award a writ of *quo warranto* commanding the sheriff of Philadelphia county to summon the Western Union Company, the Baltimore and Ohio Company, and the Baltimore and Ohio Company of Pennsylvania, before the court to show by what authority they claim to have and use their franchises, rights and privilege, and why the same should not be decreed to be escheated and forfeited to the State. Judge Simonton at once granted the writ, making it returnable on January 29. It is learned that this action on the part of the attorney-general was not instigated by anybody, but was of his own free will and accord. It was thought at one time that the recent triumph of the Garrett people in the election of a president had something to do with it, but this is disclaimed. Over a year ago the attorney-general would have moved in the matter if he had been in possession of the proof, and the delay in the movement, it is understood, was solely because he was engaged in securing testimony in proof of his allegations. The paper containing the specific charges has been prepared, but at present it is not deemed prudent to make it public.

Severe Storm in the West.

The heavy sleet storm in Missouri, Iowa, Kansas, and other Western States recently greatly disturbed telegraphic and telephone service. At one time all communication between Chicago and Kansas City was cut off. The sleet and snow worked havoc among the wires in Kansas City. The telegraph companies escaped with the usual embarrassments of delay and roundabout service. The heaviest loser is the Missouri and Kansas Telephone Company, which estimates its loss at $20,000. All their wires on Grand avenue, from Sixth to Sixteenth streets were broken down, and nearly all the poles on the same street were broken.

New Design Elevated Electric Railroad.

The accompanying illustrations show the form and construction of a new elevated railroad system, using for motive power either electricity, steam or cable, the invention of Mr. R. T. White, of 12 Pearl street, Boston. Mr. White is the inventor of many useful and important mechanical contrivances, and in his railway system has embodied the results of long experience in this line of work. The support of the track is effected by a single line of columns or posts. The car is supported at each end by a single truck, composed of a vertical wheel running on the main rail, four idle horizontal wheels bearing at each side against the channel iron girders which form the top of the track structure, and four small rollers at each corner, which run under the channel irons and come into action if the car tips unduly, or tends to leave the track on account of any obstruction. This arrangement makes it almost impossible for the car to leave the track, and at the same time it is enabled to pass around curves of short radii and prevented from swaying from side to side. The arrangement of truck frame with moving axle, loose running wheels and self-oiling and interchangeable bearing parts, is something that has long been striven for in railroad construction work. Figure 2 shows a perspective view of a curved track with car, and that it is practicable to run a car on so short a curve with this system is demonstrated by large working models which have been constructed. One method of supporting the main T rail is shown in this cut, viz, by means of a box girder, a plan and cross section of which are shown. Figure 1 shows a cross section and perspective of the track, trucks and supports. Another method is here shown of supporting the main rail by means of an I beam passing from post to post. This figure also gives a better idea of the construction of the truck, the arrangement of the idle wheels and rollers being shown. Many important details of construction, both in supports and trucks, are not shown in the accompanying illustrations, but have been worked out and are covered by letters patent granted Mr. White. One important feature is in the switches, which, in a road of this sort, present many difficulties, and much time has been spent in this work. The arrangement is such that the track is never open, even if the switch is misplaced, the main supporting rail being fixed and thus allowing the car no chance to leave the track.

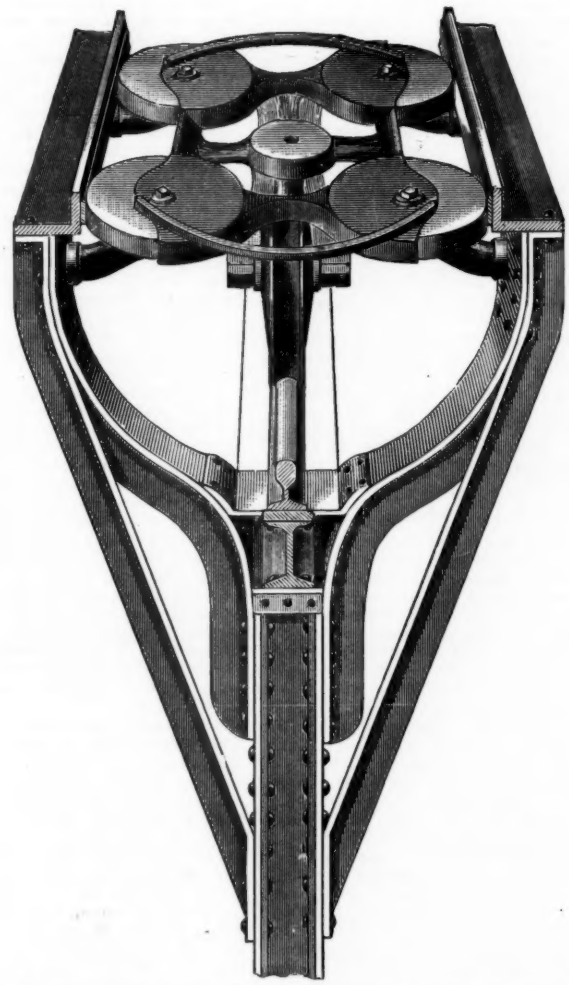

FIG. 1.—CROSS SECTION VIEW.—ELECTRIC ELEVATED RAILWAY.

PROF. BRACKETT'S ELECTRIC CLUB ADDRESS.

Complete Stenographic Report, with the Discussion.

We publish in full the very interesting address delivered by Prof. C. F. Brackett, of Princeton College, before the Electric Club, December 20th, 1888. The publication has been delayed two issues to give the lecturer opportunity to revise the stenographer's report, as he spoke entirely without notes:

Mr. Chairman and Gentlemen of the Electric Club:

This is the first time in my life that I ever had the pleasure of facing an Electric Club, so far as I remember, although it has been my fortune, good or otherwise, to give instruction in electricity, and I am bound here to confess—which is a very willing confession—that if I had students under such auspices as I should have had them here, I think I might have succeeded in teaching them something. The Electric Club of New York seem to know how to surround themselves with the physical inducements to study, and I think if students could generally be introduced into such pleasant circumstances they would be considerably more inclined to appreciate their opportunities than they are at present.

The topics to which I would invite your attention are those which present themselves naturally to the working electrician as well as to the student of electricity. Let us consider first a practical matter. I refer now to the fact, so well known, I suppose to all of you, that in the immediate applications of electricity to our daily wants we make use of those material substances called conductors, and that we interpose them in the path where we would like electricity to flow, but where we do not wish it to do so we place substances called non-conductors. It is known to you all that there is no very sharp line of demarcation between these two kinds of bodies. It will suffice in general to say that the common commercial metals act very well as conductors. I desire to draw your attention to two points, and, for the purpose of illustration without a blackboard, I will ask you to follow me with your imaginations. Suppose one point *A*, and another point *B*. They are at different electrical potentials. If we join the point *A* with the point *B* by means of some metallic conductor, we shall find that in a given time, very short, there will be no difference of potential between *A* and *B*, and we shall find also, if we use proper appliances, that something has been going on in the wire, or in the region of the wire, which connects those two points. When we say in the wire we are not sure that we are telling the truth; when we say *in the wire, or in the region about* the wire itself, we are sure. If we employ successively copper, gold, or silver wire, we shall find that the equalizing of the electrical conditions of points *A* and *B* is in general not accomplished with equal facility. In other words, we find that all bodies are not equally good conductors. Now, copper wire being generally used on account of its excellence as a conductor and its moderate cost, it interests the electrician to know when he has the most efficient variety of copper wire. The matter then which I wish to discuss with you first—and let me say in passing that if I do not make every point clear I invite questions as we go on—is how is the electrician to know that he is using the very best quality of conductor under any given circumstances. Often times he wants to use the greatest possible power of conduction with the least possible bulk. Again he may be required to use the greatest possible amount of conducting power with the least possible amount of weight, as, for instance, in the construction of certain pieces

of electrical apparatus, such as the dynamometer. He will be guided in his constructions very much by his knowledge of the materials, and especially of the conductivity of the materials which he proposes to use. Let us speak for one moment of the specific conductivity of conductors. The word is used precisely as in science we use it, with reference to other properties of matter when we refer them to a standard. It was assumed by the committee of the British Association that *pure* metals should in some way be taken as the standards to which commercial samples should be referred. In the case of copper we must be able to secure it in a state of perfect purity, and to draw it into a wire of perfectly uniform diameter. A definite length and diameter will then fix the standard. Or we may take a definite mass of copper, as determined by weighing, and fix the length of the conductor to be made from it and assume that nature will fix the diameter. Finally, we may attempt to deduce the diameter of a known length from its weight and the specific gravity of copper. All these plans are beset with difficulties. Let us discuss the matter.

If we say that a wire one one-thousandth of an inch in diameter and one foot in length shall have a resistance of 9,718 ohms, we have made a statement equivalent to the one made by the British Association Committee. How can you know that this wire is a foot in length? That is not a very difficult matter. How are you to know that it is a thousandth of an inch in diameter? There comes a difficulty. But the British Association did not attempt to make a wire just one one-thousandth of an inch in diameter. On the contrary, they drew a wire of some size and deduced from the resistance of that wire what would be the resistance of the same metal if its diameter were reduced to one one-thousandth of an inch and its length were made one foot. Now, let us, before we leave this, inquire what are the difficulties in the case. We have a wire which in general terms we will say is one-sixteenth of an inch—Matthiessen's. We want to know in tens of thousandths of an inch exactly how much it measures, for the least variation in the diameter of it of course implies a much larger variation in the area, and that implies a very large variation in the conductivity—so the slightest error made in the measurement of its diameter enters very largely into the final result. It is true that we have screw gauges and vernier calipers at our command; but yet we can hardly by any of these devices determine the real diameter to within at least fourteen or fifteen hundred thousandths of an inch, and that makes a vast difference in the conductivity of a wire, especially in the case of small wires. Let us take the other plan, specifying that the samples being a foot in length shall weigh so many grammes or grains, and then again we will have one of the British Association methods on the basis that a cubic foot of copper weighs 555 pounds—that it is nearly 555 pounds—if a cubic foot weighs about that and not exactly that, there is a doubt about it, which will seriously effect the result. The difficulty is at once seen when stated. They also specified that the specific gravity shall be so and so, or that it shall be so and so. Now, if we take the Smithsonian tables collected under the direction of Professor Henry, we shall find that the specimens of copper there reported, as respects their specific gravity, vary all the way from about 8.95 down to 8.40, a variation enough to make a very great percentage of difference in the conductivity of copper. Now, to what are these discrepancies due? The question what is the specific gravity of a metal is the one which can only be determined in a given case by taking that particular piece of metal which is to be employed and determining its specific gravity. Then let us look at the process of wire drawing. Suppose we draw the wire through the draw-plate. What is the operation that goes on? Is the wire simply stretched and made longer and smaller? Is the wire compressed as it passes through? The experience of the wire drawer will perhaps come to our aid and tell us something about it. I had occasion, some time ago, to apply to one of the most expert drawers in the great works at Trenton—Roebling's—using a jeweled draw-plate through which the wire was to be drawn, and having a finished sample of wire to be drawn through it. The workman at once said: "That cannot be drawn through it." Said I, "Why?" He said: "The wire is too small." Now there may be, and there probably are, gentlemen present who will see at once the reason of that statement. It is found that if we wish to reduce a wire from one size to another, we must reduce it by a considerable amount or we cannot draw it through a plate at all. The wire is a little large for the hole. Instead of there being pushed up a mass of the metal in front of the hole, the metal is compressed and becomes very hard, and is wedged into the plate, and breaks. If, on the contrary, the reduction in size is so great that this does not happen, it is found that it can be drawn through with moderate tractile force, and that it has a more uniform structure. Let us then consider what happens when we attempt to pull the wire through the plate; what happens to the wire after it is pulled through. Here experiment comes to our aid. If you will pardon me, I will use a pencil for illustration. Wertheim, in some experiments of his, found that when any substance is stretched, the entire bulk of that substance is enlarged. An instructive laboratory experiment is performed by means of a long mass of rubber in the form of a parallelopiped, whose length can be measured, whose side and thickness can be measured. When we stretch it we find that if it be calipered at uniform distances, and the volume under those circumstances be computed, it is greatly increased. One would naturally think that would be diminished in section as much as it is elongated, so that its volume would remain constant; but it is not so. If you take a piece of rubber as long as your finger, find its specific gravity by weighing it in the usual way, put this in a stretching apparatus similar to what is used to make one's trousers cease bagging at the knee, and you will find its specific gravity has been diminished, and the bulk increased. The same thing is true of the copper; the wire which is being drawn through the plate is kept back constantly, a portion of it is here used as spare material, as if it were still being pushed through, and after that it is stretched and enlarged. Therefore, the least bulk, weight for weight, is directly in the plate as it passes through it. Now, the question which arises here immediately is, how much it will be expended, and therefore what will be its specific gravity after it is through? You must see that it will depend on how much it is reduced in size, and what is the condition as regards annealing before it is drawn through and afterwards, so that when you state that wire is hard drawn and has such and such a specific gravity, you are stating two things not necessarily compatible. If you have a certain mass of matter having a certain length between points A and B, if the mass be highly compressed so as to occupy only a small space, one might suppose that the particles are nearer together, and therefore they could less readily execute the motion involved in the tranfser of electricity from one point to another. One might say on the other hand, if it were annealed, rendered larger, there would be greater freedom of motion, and so, a greater conducting power. Those are both theoretical matters, and there are experiments tending to prove the truth of either position. It is found that the conductivity is improved by being annealed. But what do you mean by annealing? Do you mean the wire shall go into the oven and be heated to redness and kept so a certain length of time, and then be allowed to cool spontaneously?

A short time ago a specimen of wire came to my notice to be measured for conductivity. It was found to be very low. On examining its physical properties it was found that if it was flexed sharply on itself, any attempt to straighten its back broke it short off. The question was given to me for investigation, to find to what this was due. The conductivity being too low, and on finding the physical state of it to be such as we would call brittle, it was supposed, of course, that it might contain arsenic, or that it might contain sulphur, and very rigid tests were made for these substances, but neither of them was present. Tests were made for oxide of copper, which in the annealing process might have been absorbed into the interior. On making a careful test for suboxide of copper, there was found to be no more present in it than in other wires which were tough and whose per centage of conductivity was over a hundred. Then the question arose, to what is this due? Accordingly a sample of the tough wire that could be flexed in any way you pleased, that had a percentage of conductivity of over a hundred, was taken and heated for a little time in the presence of hydrogen gas - heated to redness. It was found on cooling that it would not bear a single sharp flexure. On trying to make it bend as an ordinary wire, it would break half way off. It appears then, that by the pressure of hydrogen and the existence of a high temperature, a new molecular condition was impressed upon it. This investigation was made by Dr. McCoy.

Now, along the same line I might note another experience which was accidentally come upon. A large amount of iron wire was made for telegraphic purposes. It was shipped to its destination, and on being unloaded roughly as usual the wire was found to break into pieces as if it had been a rod of glass. On being carried back to the factory and nothing else done to it except to draw it through the draw-plate, it was thoroughly restored, showing that the whole matter is due simply to molecular change—that it was restored by mechanical treatment.

Now this short discussion will settle the point which I have brought up—what did the British Association mean when they said a wire so long having such a diameter shall be taken as a standard? They mean absolutely nothing, for they have not specified how it is to be drawn through the plate; they have not specified how it is to be annealed or how many times it is to be annealed, or any specific mechanical detail about it.

Now, let us consider another phase of wire drawing for a moment. Suppose we had a standard. Suppose these questions were all settled, first as to the purity of the material, second as to the method in which it should be drawn, and how it should be annealed, and what kind of draw-plates shall you draw it through. If you are to use jewels, such as a topaz or something of that sort, for every final drawing of the wire, that course would seriously embarrass every concern in the community. You can draw only a very limited amount of wire through the plate, and then it is worn out. We must, therefore, fall back on steel, the only available thing, and see how that will work.

I will narrate a little experience. Having wires sent to me by various firms to study and report, I have invariably found that when a lot of wire which was continuous, without any joints, was examined both ends of the wire were large and the middle small. I think that is probably the experience of all—that the middle is reduced. What, therefore, is the diameter of the wire?—how shall we get it? It is larger in one diameter than the one at right angles to it, and gives you neither a circle, an ellipse, nor any other regular geometrical figure. Well, of course those who wish to save trouble say, let us weigh it. Suppose we determine to measure it without weighing it. Of course we will have to run our calipers around the wire and we have to discuss the figures we shall get from that, and having determined the area of the cross-section and the length of the wire we can refer it to the standard of the British Association, and if that were accurate our work would be done.

But we find that it is not safe to assume that these wires will be uniformly smaller in the middle, and we have, therefore, to look into the facts. When we begin drawing the wire through the plate the first effect of it is to heat the plate. Before the heat is conducted in the outer parts of the plate the interior parts get warm, and they have no other way of expanding except inwards, thus contracting the hole. The consequence will be that, for some time, the wire will pass through the hole at nearly its full diameter; but from the beginning the heat evolved in consequence of friction will cause the diameter of the hole to decrease until at length a point will be reached when the conduction and radiation from the plate will remove the heat as rapidly as it is produced. Meanwhile the rough surface of the wire will cut away the plate and thereby increase the diameter. There will thus be two stages in the alteration of the draw-plate; during the first the diameter will on the whole be diminishing, and during the second it will be increasing. Accordingly the wire will be smaller at some point between the extremities than at either of them.

The wire will then be of varying diameter, and one who would ascertain it for the purpose of finding the conductivity of the sample, will have to make a series of measurements at various points along the length as well as in various azimuths about its axis, very much as the surveyor treats an irregular piece of land. Suppose he wishes to avoid all this labor, and says, I will weigh it. There is difficulty if you do weigh it—how will you deduce the bulk from the weight without knowing the specific gravity? If you turn to tables you will find 20 or 30 different specific gravities assigned to copper wire. If you say, I will determine the specific gravity myself, then the expense will be too great if any considerable number of samples are to be tested.

Now, having stated some of the difficulties with reference to the matter, let us inquire what ought to be done. It is known, I suppose, to most of the gentlemen present, that the British Association Committee still have this matter in charge, and have undertaken, at their recent meeting at Bath, to have the whole question re-examined, and it is to be hoped that something will be elicited which will give us a standard for the conductivity of copper wire, so that we shall know whether we are getting one thing or another. It may surprise some of you to be told that we very frequently have from the manufacturers in this country samples which will run as high as 103 or 104 per cent. of conductivity. In other words, they are three or four per cent. better than they can be, taking the British Association as a standard. Now the matters which I have already brought forward, of course, enter into the reasons. I stated at the outset it was assumed that the pure metals were to be accepted as standards. That is not the whole matter. It does not by any means follow that when you have assured the purity of a metal you have secured the highest conductivity. You have also to ask what is the length, what is the diameter, what were the methods of its preparation, and, unless they are all defined, there can be no certainty that you are getting within two or three, or three or four, per cent. of the proper conductivity.

Now some one says, what is the use of this after all? There are conditions in the art of the practical electrician in which he must say beforehand, precisely how many feet of wire he can employ, precisely how much space they must build up in order that he may have symmetry, equality and proper conducting power. I think any one who has attempted to wind the coils of the dynamo machine so as to secure a definite number of ampere turns will agree that a variation of two or three per cent. in the conductivity of his copper wire makes the difference between success and failure.

Now, having said so much with reference to a practical problem that interests everybody, let us turn our attention a few minutes to matters that are more speculative. It is not only true that it becomes important for us to have conductors which shall convey from one point to another the disturbances which we call electrical; it is also true that in the construction of machinery at the present time we are to take into account the air spaces between those conductors; we have to take into account the intermediate thing which separates one conductor from another, and inquire what goes on in that space. And it will not astonish many present when I put it this way. Theoretical electricians who are studying the question very hard are getting to look at it in this way. We are not more concerned with what goes on *in* the conductor than we are with what goes on *about* the conductor. In other words, the principal transaction in the electrical transmission of energy from one place to another goes on not in the substance of the wire but in the space which surrounds the wire. We ought to get into the spirit of these electricians, and look at the ether through which we move as the most important of all materials with which we have to deal. Think now of the air and of everything utterly vanished, a perfect vacuum, and then cut out a solid "chunk" of the vacuum and see how it behaves. We shall find, probably, in the light of these investigations that this is the most important thing we have to deal with, that the whole action which we call transmitting goes on in that, and that the conducting wire is only a hole bored through it. It is simply so many masses of matter called molecules that are swinging around and making an easier path, and this determines the direction through which the electrical disturbance shall be manifested. There are certain transactions which we may look at. For instance, a wire can act inductively through a vacuum just as well as through the air. No one is, I think, able to imagine to himself, under any circumstances, whatever he may say, action across a space where nothing exists. Faraday in grappling with this same subject said, in substance, that it was unthinkable. Newton gave his great deliverance also along the same line.

If, then, action at a distance must be ruled out, there is something between the conductors themselves which we have to take into account. Now the experiments and researches to which your attention has been called in the electrical literature of the day, which have been going on for several years past—in fact they date back many years—have cast a great deal of light on this subject, and while it may not seem immediately practical, it may be that some word which will be dropped in what I shall say, or in the discussion, will set some one to thinking.

Now, in order to proceed step by step, let me propound the ultimate question which I suppose may interest a large number—how to produce an electric light in the very cheapest possible way. That is a practical question. Now I am going to try to see if we can get to it in a philosophical way (without realizing it), but upon the paths if possible by which it will probably be ultimately reached. Faraday, in one of his brilliant papers in which he set forth the principles of "the new electrical machine"—the starting point of modern dynamo appliances—made use of words like these:

"I have rather, however, been desirous of discovering new facts and new relations dependent on magneto-electric induction than of exalting the force of those already obtained; being assured that the latter would find their full development hereafter."

Now, in the light of what Faraday said, let us look at this subject. Nothing will be practical that I shall say. I shall not show you how to make that machine, but I propose to scale past the lines along which it may come, and in doing so I will be very brief. First, what is light? This solid ether which we have spoken of, which is a necessity in the phenomena of light and which Fresnel assumed has an existence, in order to tie together the inevitable deductions from his equations, must be thought of as something evidently more solid than the solidest things we think we know about. When we get light we get it by setting up vibrations in the ether, and all I say about these vibrations is this: They are periodic, they are uniform, they are transverse to the line of progress, so that if the beam of light were going directly from me to you, the motion is athwart the beam, so that a particle can be thought of as moving this way and another around that way (illustrating with a pencil), and so in every possible direction at right angles to the line from me to you about that. Now the question is: Is there anything connected with electrical science by which we

shall be able directly, ultimately, to evoke that method of movement? In 1832, Prof. Henry showed that when a Leyden jar is discharged the spark which we have been perhaps accustomed to think of simply as a passage of electrical fluid from one side to another, on the contrary, was a series of transmissions back and forth from the outside to the inside. This he showed to his own satisfaction and embodied his conclusions in a paper which is of course extant at the present time. Later, Fedderson took up the question and studied it with care, and showed how to compute the length of time involved in any one of the elementary discharges passing back and forth. In 1855, Sir William Thomson showed how to compute from the induction of the wire and the capacity of the jar, the time interval involved in one of those oscillations. Here is a trough of water on one end of a pipe and another on the other end. The one trough being empty, water runs through and accumulates on one side and by its impetus it will pile up a little higher and we will have a series of oscillations, and finally it will come to rest. That is exactly what happens when a Leyden jar is discharged by a series of oscillations. Now we can put such a conductor between the two troughs that there shall be only a steady flow from one side to the other. We shall find that there will be no oscillation in that case back and forth. If we put there a very small wire or a wire having large inductive capacity, I can get a steady discharge in the case of the Leyden jar. Any way we can primary system are shown by the induced sparks in the rectangular system. If the periods of oscillation in the two systems be made as nearly as possible the same, the brilliancy of the spark in the secondary is much increased—just what should happen on the principle of resonance. There are then waves set up in the conductor, and their frequency can be calculated. Now, according to the electro-magnetic theory of light proposed by Clerk Maxwell, the disturbance which constitutes electrical induction should travel with the velocity of light, or about 185,000 miles per second. It is then easy to find the length of the oscillations which any given number of alternate discharges, such as are produced in the experiments of Hertz, for we have only to divide this distance, 185,000, by the number which gives the length of one, provided we may assume that the disturbance is propogated in the wire with the same velocity as a disturbance is propogated in the air. Hertz, however, found that this is not the case. His experiment was carried out somewhat in this way: Two large metallic plates were furnished with wires terminating in knobs, and so placed as to be in the same vertical plane, with the knobs near each other, so that a spark could pass when the two were connected with the induction coil terminals. Behind one of the plates was placed a third, so as to be parallel to, and near it, and from this a wire was led to a considerable distance away and put to earth. Any electrical disturbance in the plates joined with the induction coils would, of course, induce a corresponding one in the third plate, and so in the wire connected with it. Suppose we want to find out whether there is anything going on analogous to the transmission of waves in sound, we would go alongside of the wire and see if there is a place where there is a ventral segment, and further, if we find that repeated again and again, in other words, we ascertain if there is a series of waves—what kind of a glass shall we employ for this purpose?

All we have to do is to make a little induction coil, put a knob on each end of the coil and bring them near each other, and see whether a spark passes. Suppose the wire be stretched here (illustrating with an imaginary wire), we look carefully and find a spark passes. Then passing along the spark grows dim, now it grows a little stronger; we find it here very strong; we pass right on and find that when we go over the same distance again it increases and diminishes. If we do this we find the distance between the nodal points. In other words, I find the result absolutely, the result we were looking for, by the inductive effects in the wire. (Applause.)

Now I will not weary you with that part of the thing, for there are a great number of experiments which can be tried. We can find this instance. When the wire transmits these electrical disturbances, there is in the ether, or in the air, close by its side, another disturbance transmitted: that is to say, we have the one taking effect along the wire and the other taking effect along the ether. Now do they travel with the same or with different velocities? You will find by making connections across the various points and you will find certain points where there is no motion between those two, but if you string them in down here to a point where there is a movement you will find in other words the rate of transmission in the wire is different from the rate of the transmission in the ether. Hertz find that if he employs iron wire, copper wire or zinc wire, or wire of any other metal, it makes not the slightest difference in the position of the nodal points. In other words the length of the wave remains unchanged and it makes not the slightest difference whether the diameter be small or great.

Now, let us look at what light is for a moment, and then we will see how we should produce it. I have already stated that light is a motion transverse to the line of progress of the wave. Now I am going to ask you to follow me through a little severe thinking.

Faraday, in the height of his enthusiasm as an experimenter, endeavored to connect gravitation directly with electricity. He made coils of wire and threw them out of an upper story window and let them fall down to the earth-field in order to see if he could get any galvanic disturbance. Faraday had already investigated an action closely analogous to that of gravitation, for he more fully than any one else explained or rather described the character of the region about a wire which is conveying a current of electricity. Here is a wire and a current. Suppose a current is passing directly down through it. I need not discuss now what a current is, but will take it for granted that the wire joins the brushes of a dynamo machine. Now bore a hole in a glass plate, push the wire up through the plate, send the current down through the wire, sprinkling some ordinary magnetic sand, such as was once used on the writing desk, all about the wire. When the current passes we shall find on gently tapping the plate that there are arranged certain well marked lines around the wire in more or less perfect circles. Now we have mapped out what are called circular lines of force, and the region is called a field of force. Now let us see what properties this has. If in such a region we bring a pole of a magnet, and this be perfectly free to traverse around it, we shall have this magnetic pole revolving along these lines of force, and when it has gone around the circle a certain amount of work will have been done. Now suppose, in order to make clear, we split the conductor down the axis here (showing with a pencil), this way here, and so on, turning through a certain number of degrees each time and in every one of those splits we insert a card then we shall have a fan wheel, every one of these cards will represent an equi-potential surface. This floor on which I stand, supposing it to be level, is such a surface as respects gravitation. It is an equi-potential surface on which we can place a locomotive

(*Continued on Page 6.*)

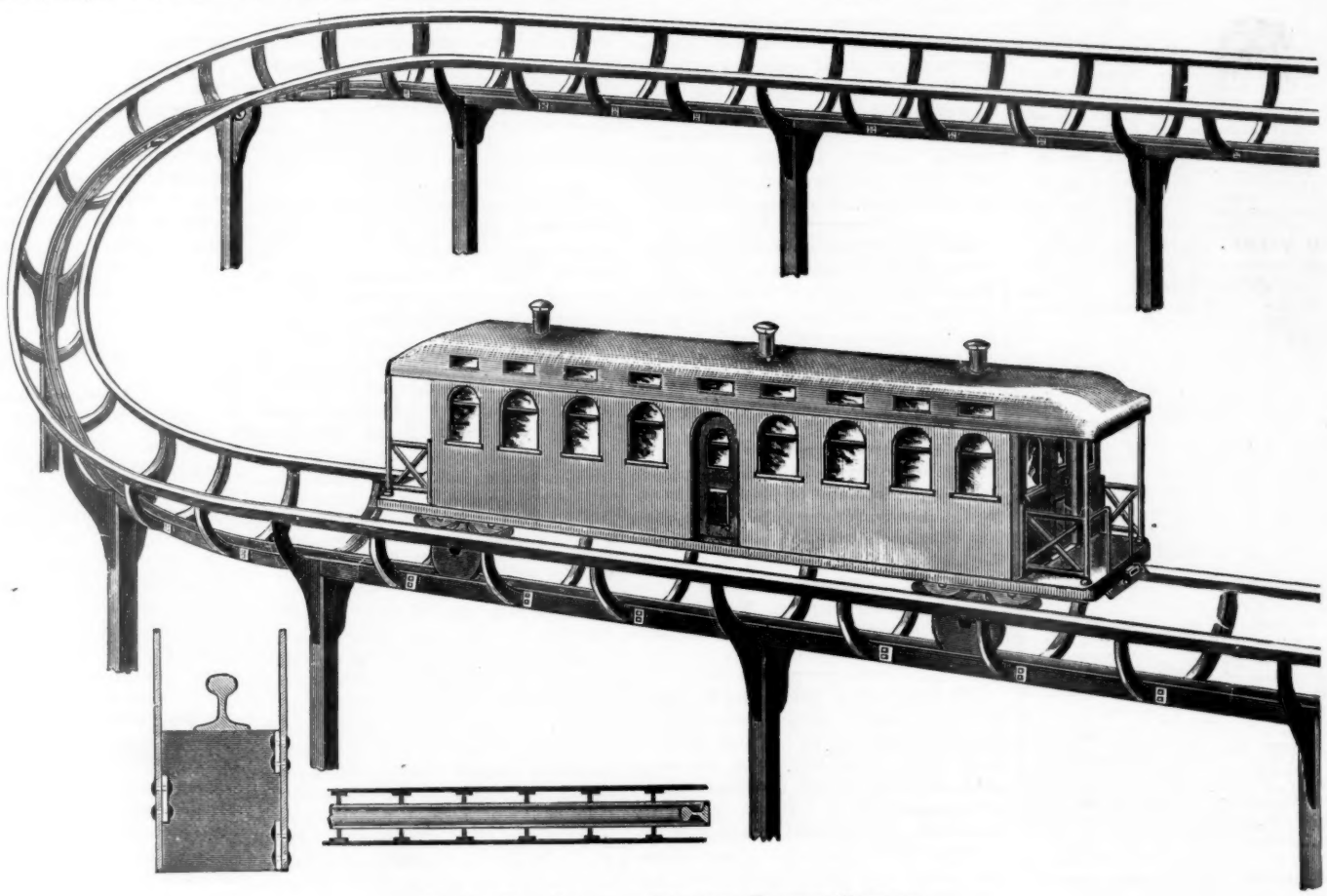

FIG. 2.—NEW DESIGN OF ELEVATED ELECTRIC RAILWAY.

control it and show what is the length of time involved without any difficulty.

Now, to make a long story short, it may be stated that Hertz has for some time been studying the oscillatory discharge, and his more recent labors have thrown a great deal of light upon them. I will not allude to all of his experiments in order, but only mention such of them as best suit my purpose. In order to understand one of them, consider a simple experiment in acoustics. A long rod of wood or metal is held firmly between the thumb and finger at its middle point. If it be pulled gently with the other hand, which has been covered with a little powdered rosin, the rod breaks out into a clear musical note, as clear as that of a violin. The effect of the friction has been to produce a series of condensations and rarefactions which travel along the rod, thus showing that it is in vibration. Hertz arranges a long wire with a metallic conductor of considerable capacity on each end. The wire is cut apart at the middle point, and the ends so made are brought in contact with the discharge rods of the induction coil, which are furnished with small balls between which the spark can pass. A small rectangle of wire with one side cut open at the middle, and the two ends armed with small adjustable balls, serves to show what is going on in the long wire system just described. This it can do by the presence or absence of a spark at the opening between the balls. When the induction coil is set in operation, the electrical oscillations in the

Chippewa Falls, Wis.—The Chippewa Falls Electric Light Company; amended articles, increasing the capital stock to $15,000.

Dedham, Mass.—The Dedham Electric Company, of Dedham, has been incorporated, with a capital of $250,000, for the purpose of furnishing electric light and power.

Chicago, Ill.—Hyde Park District Telegraph and Electric Company, of Hyde Park. Capital stock, $10,000. Incorporators, Jas. Crape, C. H. Caldwell, Isaac Lake and F. M. Winters.

New York.—Universal Gas Lighting Company, of New York. Capital, $100,000. Trustees, Ed. D. Peters and Harry T. Downs, of Saratoga, and Loren N. Downs, of New York.

Altoona, Pa.—The Altoona Manufacturing Company; capital, $100,000. The company will manufacture engines, boilers, cars and all kinds of machinery.

Chicago, Ill.—Rogers Park Water Company. Capital stock, $50,000. To furnish water and electricity. Incorporators, H. A. Keeler, F. D. Keeler and N. A. Partridge.

Chicago, Ill.—The Phœnix Electric Fire Escape Company, of Chicago. Capital stock, $130,000. To manufacture and sell patent fire escape. Incorporators, C. O. Meyer, W. S. Bates and Andrew Egbert.

Kennebunk, Me.—The Union Mill Company. Capital stock, $20,000; paid in, $100; par value of share, $25. The business of the company is to furnish power for generating steam and electricity. Incorporators, S. T. Fuller, of Kennebunk, and others.

Pittsburgh, Pa.—The Association of Young Engineers, with headquarters in the McCance building, has been formed, with the following named officials: N. J. Mitchell, president; Charles Wilhelm, vice-president; Geo. R. Ward, secretary; W. J. Totten, corresponding secretary; A. T. Keller, treasurer; W. L. Crosgrove, librarian.

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T. J. McTIGHE, Electrician and Manager Patent Bureau.

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CONTENTS.

	PAGE.
A Suit to Declare Forfeit the Property of the Combined Telegraph Companies	1
Severe Storm in the West	1
New Design Elevated Electric Railroad	1
Prof. Brackett's Electric Club Address..1, 2, 3, 6,	7
New Corporations	3
What's in a Name	4
Underground Danger	4
Our Wide-Awake Correspondents:	
Our Boston Letter	5
Our Chicago Letter	5
Our Washington Letter	5
Our Letter from the South	5
Our Pacific Coast Letter	5
Telephonic News	6
The New Telephone Building in St. Louis	6
Electric Power	8
Electric Club Entertainment	8
Get Ready for the Electrical Exhibition at Chicago	8
The "Electric" Sugar Swindle	8
Personal	8
The Next Electric Club Lecture	8
Thanks Awfully; but we Prefer our Own Name	8
Manufacturing Notes	8
Johnston Electric Train Signal	9
The New Stations of the Edison Company in this City	9
An Electric Christmas Tree	9
Electric Light News	9
The New Year	10
A Very Excellent Telegraph Brigand	10
Our Medico-Legalities Furnish Amusement for English Electricians	10
A Carriage Call	10
A Decision Against the Gas Light Company	10
A Promising New Storage Battery	10
Be Careful at the Telephone	10
Electrical Patents	11

Oh, electricity! What crimes are committed in thy name!

Electrical men generally should plan to be in Chicago during the next electric light convention.

It was not a palatable pill the believers in electric sugar had to swallow. Nevertheless, it was clearly sugar-coated.

Over a million dollars invested by wise business men in a scheme about which none of them knew anything! Was it the word "Electric" that charmed?

Remember the date of the Chicago Convention—February 19th, 20th and 21st. It will be the largest and probably the most important in the history of electricity.

Efforts are being made to secure a special train-load of delegates to the Chicago Convention from New York, comprising attendants from Boston, New York, Philadelphia, Baltimore and Pittsburgh.

We are glad to see that the ornamental glass people, taking the hints of the ELECTRICAL REVIEW, have hit upon designs for electric light lamps and shades something better than gas fixtures clumsily altered.

It is a good joke on the New York police that Captain Ryan of the East Thirty-fifth street station kept a short section of Edison underground conduit carefully immersed in a bucket of water for several days supposing it to be a dynamite bomb.

The new year, 1889, promises, even thus early, to bring forth a number of novelties in the electrical field, and we anticipate the pleasure of giving our readers not a few surprises in electricity and the kindred sciences. We have one in store for them now.

The REVIEW could say "I told you so" in the case of the "electric" sugar swindle, but it wont. Still we think some of our friends in the sugar countries who have been writing us so often and who wanted so badly to invest in the scheme, will admit that we were pretty fair every-day sort of prophets.

Articles of incorporation of the Edison General Electric Company, have been filed in New Jersey, with a capital of $12,000,000. The incorporators are Edward H. Johnson, Chas. Bachelor, S. Insull and A. O. Tate. This is supposed to mean a union of all the Edison electric light interests into one big company.

It seems that the term "buried" is not so specific as one might suppose, for the Subway Commissioners, working in full knowledge of the law, count some seven miles of cables attached to the elevated railway structures as "buried." Truly ours is a wonderfully flexible language and well suited to the needs of political machines generally.

The United States Illuminating Company, of New York, has sued the members of the Board of Electrical Control, personally, for $200,000, for damages resulting from the Board's interference with the business of the company. President Lynch, of the light company, also alleges favoritism on the part of the Board. The suit may develop some interesting matter.

How interesting 'twill be, the comparison between the apparatus supplied to the Metropolitan (London) Company by the American and English manufacturers; the former having already been awarded the contract for the first central station, and the next to go to an English company. Nothing in the recent "educational" campaign will have supplied more valuable data!

The New York & New Jersey Telephone Company announces an increase of telephone rental in Brooklyn from $90 to $120 per year for new subscribers. This increase is made necessary by the additional cost of underground service. This is one of the best managed companies in the country, and that they find it absolutely necessary to take this action, is a point that the numerous uninformed advocates of underground wires will do well to bear in mind.

American inventors will undoubtedly feel more like sending models of unpatented apparatus to the International Exposition at Paris, in 1889, now that it has been decided that such an act on their part will not invalidate a subsequent application for a patent. It will be remembered that this was also the case under the Patent Act of 1883, with the proviso that descriptions of such inventions had to be filed at the Patent Office prior to the Exposition. This restriction is now done away with. Full particulars regarding this question have not yet officially reached this office.

If a man were able to pump water from sunrise to sunset he would perform an amount of work equal to that of three men working four hours. So, a small steam engine can energize an electrical accumulator during the day so that it may feed an incandescent system at night while it, in turn, turns its own energies, by the interposition of dynamos, to arc lighting. It is thus a light company is working in Springfield, Mass. With a system including 378 large cells, taking up a floor space of 20x15 feet and eight feet high, it is enabled to run 500 incandescent lights 10 hours, and then use its engine up to its full capacity for arc lighting.

The electrical transmission of power to a distance, looked upon by some as the most important department of electrical science, is attracting considerable attention in Austria. Some time ago, the shafting of a 100 horse-power mill at Steyrermühl was run from power collected on the bank of a running stream nearly half a mile distant, and transmitted over a wire in the form of electrical energy. So steady has been the supply, and so cheap, another and larger mill—400 horse-power—is preparing to follow suit; three great turbine wheels being placed under the falls of the stream and connecting, by means of shafting and cog-wheels, to the generator on the bank.

We are all having a crack at that Medico-Legal committee that told us how to kill our criminals by means of electricity. But they are all good fellows, and they seem to retain their appetites and good looks, notwithstanding they have been skilfully scalped. As much cannot be said for the young-man-from-the-West, their adviser, Mr. Harold P. Brown. He thinks he has been greatly abused, vilified and harrassed, and the sweet juices of his nature have turned to blue vitriol. Yet in this little electrical scrapping match, the REVIEW as an independent observer must admit that the young man Harold shied the first brick and thus invited the aforesaid trouble to his peace of mind.

All of those interested in the advancement of electrical science and the development of electrical industry, will be gratified to learn that Sir William Thomson, who is undoubtedly the greatest living electrician, has been unanimously elected president, for the ensuing year, of the Society of Telegraph Engineers and Electricians, which institution is at the present time the most dignified body of English speaking electricians in the world. We say this reservedly and with a full measure of respect for our American electrical institutions, of which we, and we know all our countrymen, may be justly proud. The life work of Sir William has fallen like a benediction on the world and may be seen ministering to the wants and needs of every civilized nation.

Like all other great blessings to mankind, electricity, the best of all, cannot be expected to escape the sharp eye of the speculator, but it is too bad that the wonderful current should be ostensibly used for duping humanity. It is not the first time—it has long since been potent enough to gather the shekels of the poor deluded primary battery enthusiasts. Now we have it again, the *ignis fatuus* of a sugar refining process, which was to, and in a measure did, electrify the sugar-making community, and so strongly as to pull the money out of its pockets so long as they were insulated on the stool of greed and avarice. Why cannot people in such cases look once in a while into the columns of journals which make it their business to find out new electrical industries, and either endorse or condemn?

There are still occasionally to be found institutions, in this enlightened age, too short sighted to use the good things the gods give them. The Chamber of Commerce, Cincinnati, has decided to charge the Western Union Telegraph Company rent for its space in the new chamber, and the result is that that august body will be left without telegraph facilities after the New Year. This is all very foolish. It is a general principle of equity that those who enjoy money-making privileges shall pay for for them, even though they render a public service. It is also true that public servants pay less for such privileges than those who are not of such public use. It is rather a nice point however to always decide who is, and who is not a public servant. Probably the best forensic talent of the land could argue on either side of the question: Which is the greater public servant, the ancient colored gentleman who sells sandwiches in the corridor or, the telegraph office in the same place? The dispute between the Chamber of Commerce and the Telegraph Company can end in but one way.

WHAT'S IN A NAME.

As has already been noted in a previous issue, the familiar name of the "Society of Telegraph Engineers and Electricians" is soon to become a thing of the past with only a historical significance and the new name "The Institution of Electrical Engineers," which has already been informally adopted, will be in all probability officially confirmed at a meeting early in January. "And thereby hangs a tale" of home interest to Americans. It will be remembered that Dr. A. F. Mason, reporting for the Committee on Constitutional Revision, at the last semi-annual convention of the National Electric Light Association, advised that the name of that body be changed to "The Electric Association," his argument being that the word "National" was not broad enough to cover its geographical boundaries, and the words "Electric Light" were by far too restrictive to cover its field of usefulness. This movement was opposed and defeated by some of the ablest debaters in the Association, on the ground that the present name is widely known, and it would be a very radical move to abandon it just at the moment when it was becoming useful. In this argument the Society of Telegraph Engineers and Electricians was held up as an example of an institution successfully retaining an entirely inappropriate name, though it was at that time known in this country that the above change was being talked of. This must not be construed to mean that the REVIEW regrets that Dr. Mason's recommendation was not adopted, or that the name he proposed was the best one that could be devised, but it is our opinion that the present name of the chiefest among American electrical institutions will eventually be modified so as to more clearly define its limits and functions. Probably it will be wise to let the present name remain until the Association has developed into something like its proper size and importance.

UNDERGROUND DANGER.

The Boston *Herald* contains an editorial on this subject in its issue of December 28th, very wisely calling attention to the dangers, incident to the craze for placing underground everything which can be buried in the street. The casualty referred to, was an explosion of illuminating gas which had leaked into an underground conduit of the Boston Heating Company. The article is as follows:

The explosion which occurred Wednesday evening in Oliver street, resulting in the death of one man and the serious injury of another, shows that the methods that have recently come into general use of carrying pipes, conduits, wires, and other conductors of water, steam, gas, electricity, etc., underground, are not without their special dangers. It is probable that the accident in question was due to the carelessness of the man who was killed by the explosion; but, then, the average man is apt to be careless; at least, it is never safe to assume that he will at all times exhibit a high degree of prudence in everything that he does, and it is also probable that the men in the employ of the Boston Heating Company have repeatedly gone into the viaducts that it has built at various points in our streets in precisely the same manner as on the occasion in question. The repeated digging up of our streets by various companies for the purpose of laying underground systems of one kind or another has had the effect of injuring, to a greater or less extent, the underground systems of other companies. It is a well known fact that the recent laying of the gas mains in Tremont street seriously disarranged the underground system of one of the electric light companies, and it is not improbable that the Heating Company, in putting down its system, may have caused leakages, either in the gas or the sewer systems that were in the vicinity of its pipes or its viaducts, sufficient to lead to an escape of a considerable quantity of sewer or illuminating gas. The underground method is by no means so simple as many persons have assumed. If a great viaduct could be built under all of our streets, capable of containing pipes, mains, wires and other means of conveying water, heat, light and electricity, then, indeed, it is possible that both safety and convenience could be assured. But the expense of constructing an underground system of this kind would be simply enormous, making it altogether out of reason to suppose that anything of the kind will be attempted for a long time to come.

OUR WIDE-AWAKE CORRESPONDENTS.

Their Interesting and Newsy Reports From Different Cities.

OUR BOSTON LETTER.

Sale of the Schuyler Company to the Thomson-Houston.—The Thomson-Houston Electric Company has bought a controlling interest in the Schuyler Electric Company, which removed from Hartford to Middletown last year. Then $200,000 of stock was owned in Hartford, and $50,000 in Middletown. The T.-H. Company has bought the Hartford stock and has signed a contract to buy the Middletown stock at par within two years, guaranteeing five per cent. a year till they buy. The plant will remain in town and will be enlarged so as to employ 300 men. This purchase will end all agitation with Lemp & Wightman over the valuable cut-off patent which has been in the courts for years. Lemp & Wightman, who formerly worked for the Schuyler Company, are now employed by the Thomson-Houston Company.

Personal.—Mr. Harry G. Clay, Jr., who has recently become the Philadelphia agent of the stationary motor department of the Thomson-Houston Co., has been a Boston visitor.

Increase in Stationary Motor Business.—The constantly increasing business in the installation of stationary motors of the Thomson-Houston Co., has made it advisable to create a separate department for this class of work, of which Mr. H. C. Spaulding has been appointed manager. Mr. Spaulding has been with the company but little over a year, and his steady success has fully proven his fitness for the position which energy and industry have now won for him.

"General Uses of Electricity."—Mr. C. J. H. Woodbury, who needs no introduction to electrical readers, gave an address at the Electric Club rooms on Wednesday evening on the subject, "General Uses of Electricity." Among the many points of interest touched upon in his extempore remarks were watchmen's clocks, independent circuits and arbitrarily broken circuits, electric lighting by the various systems, the telephone, local and long distance, standard time, fire alarm systems including auxiliary and automatic, thermostats, the telegraph, and reference was made briefly to recent interesting experiments in static electricity, and also in electro-metallurgy, touching on copper pipes, ferro-aluminum, and the Cowles' aluminum process. Mr. Woodbury's remarks were so full and comprehensive that a discussion was deemed unnecessary. Many amusing anecdotes were related in the course of the address, some peculiar effects of electric shocks on animals proving particularly edifying to the many members present. The regular monthly meeting of the Club will be held this evening, when the newly elected officers will be installed, and other important business come up for action.

An Editor's Marriage.—Mr. R. F. Ross, the popular manager of *Modern Light and Heat*, has returned to this city after several weeks' absence, and is receiving the congratulations of his friends on his marriage, on December 20, to Miss Ada M. Henderson, at the residence of the bride's father at Moose Brook, Hants County, Nova Scotia. Mr. Ross has been building up his health in hunting and fishing in the Nova Scotian woodlands, and returns to his work with renewed energy.

The West End Electric Railway.—The electric cars on the Allston division of the West End Street Railway, Sprague system, have been running regularly several days both on the overhead and conduit (Bentley-Knight) systems and giving great satisfaction. They are crowded to the utmost on every trip, and the people lining Boylston street, at all times, to "see the electric car go by," are reminiscent of circus days. But one or two mishaps have occurred of a minor character, one being the burning of a small canvas motor covering under a car, on account of which a needless alarm of fire was rung in. The Sprague Company, Messrs. Sawyer and Blake, its New England agents, the Bentley-Knight Company, and Mr. McQuesten, the contractor, all come in for hearty congratulations on the success of their portion of the West End Street Railway Lines. T. W. S.

Boston, Jan. 7th, 1889.

OUR CHICAGO LETTER.

Electric Light and Power Inspection.—The city electric light inspector's record shows the following figures for the year just closed:

Arc lights inspected during 1888	2,369
Incandescent	17,717
Total for the year	20,086
Inspection of previous years	22,756
Total to date	42,842
Motors inspected, constant current	34
" " constant potential	19
Total for 1888	53

It will be seen from the above that business in electric lighting has been far from dull during the past year. The number of arc lights given, 2,369, should be increased by the city plants, both river and street, 294, giving a total of 2,663 arc lights which have come into the record of 1888.

Electric Light Belting.—The Chicago Rawhide Manufacturing Company is in market with a belt which has proved eminently successful and serviceable for high speed engines, and is therefore most excellent for electric light dynamos. This company also manufactures a solid rawhide pulley, which, being of a non-metallic substance, is well adapted for electrical work; and is claimed that the material of which these—both belts and pulleys—are made is such as to reduce the static electricity manifestation to a minimum

Telephone Rental Reduction and Wire Burial in Missouri.—The State Senate of Missouri will be called upon on the 6th inst., to consider a telephone and an underground bill. The first of these is as follows:

SEC. 1. The annual charge for the use of a telephone in all cities in Missouri having 100,000 inhabitants or more, shall not exceed $50; and in all cities, towns and villages in Missouri having less than 100,000 inhabitants the annual charge for the use of a telephone shall not exceed $36.

SEC. 2. Any corporation, president, agent or officer thereof, and any person who shall charge, collect for the use of a telephone any sum in excess of the rates fixed by this law, shall be deemed guilty of a misdemeanor, and on conviction shall be punished as prescribed in Sec. 1,663 of the General Statutes, and every such case shall constitute a separate offense.

The underground bill provides that in cities of the first class, the Mayor, Board of Improvements or other proper authority, may compel telegraph, telephone or other electric wires exposed for public use, to be placed underground or strung in the air at such a height as not to endanger life or interfere with the fire department.

The Chicago Telephone Ordinance Adopted.—The Chicago telephone ordinance came up in the council last evening, and was put upon its passage. There was considerable discussion, and the Druggist Committee and the Telephone Subscribers' League were denounced by Cullerton as humbug concerns. The tax was commented upon as bribery, and "the monopoly was in a hole, and the council proposed to help it out if the majority report is adopted," was the way another alderman stated it. Another said it was "notorious that the hawkers of the $85 and $75 petitions asked a pledge of payment for services in case the reduction was secured." One charged that there was boodle on the side of those who opposed the ordinance. "The leader of the druggists' association," said Cullerton, "had acknowledged that he made more money out of his telephone than he paid rent." The ordinance was adopted by a vote of 27 to 16. The old Bell ordinance was then repealed by an unanimous vote. The new ordinance provides that within the central portion of the city the company shall place two miles of wire annually underground. When the central portion is thus taken care of, the outer districts of the city shall be treated in a similar manner, if the city shall so direct, at the same annual rate of undergrounding. The financial portion of the ordinance requires, at intervals of six months, a report of gross receipts for the past half year, and a payment of three per cent. per annum on such receipts. The company cannot increase its rate of rental. The company will connect its wires with the various departments in the City Hall, placing an exchange telephone within each of the offices so designated, nine in number. It shall rent telephones to the city for the use of the police and fire alarm systems of the city, at a rate not to exceed $5 per instrument.

The city is not in any way prevented nor restrained from exercising any of its rights to make rates or issue licenses, when authorized by the Legislature, in accordance with an ordinance passed under such authority in the future. In short, the city surrenders no rights it may have had previously to the passage of the ordinance.

The company cannot enter into combinations with other companies, so that a "Trust" is impossible. The ordinance is to endure for 20 years.

There is no clause to prevent a "wail from the tied," but the druggists and the liverymen, and the generally dissatisfied, presumably, will all go into mourning, because the city council refused to aid them in cheapening what they have quite generally designated a luxury.

Personal.—Mr. Fred. De Land, who has for the past year or more been in the employ of the Electrical Supply Company here, has severed that connection, and become one with the Sperry Electric Company, of this city. C. C. H.

January 5, 1889.

OUR WASHINGTON LETTER.

Another Electric Railway.—The construction of the second electric road in this District will soon be commenced. The Rock Creek Railway Company, chartered by the last Congress, with a capital of $60,000, is to run from the end of Connecticut avenue across Rock Creek, and out to the neighborhood of President Cleveland's country residence. It is expected that three miles of the road will be completed and put in operation by the first of May. As the whole of this line is outside of the city limits, it is not affected by the law prohibiting overhead wires, and that system of conductors will be used. Two 100 horse power engines will be used to drive three dynamos, two of which will furnish current for the car motors and the third will supply arc lamps for lighting the road and Woodley Park, through which it runs. The president of the road is George Truesdell, who has made such a decided success of the Soldier's Home road. Proposals for the electric work have been received from the Thomson-Houston and the Sprague companies.

The Capitol Lighting.—A small army of experts in dynamos, wires, engines, electroliers, etc., has been exploring the Capitol building, this week, gathering data for their estimates for the lighting proposals. Nearly all the large companies are represented.

Weather Telegraphy.—Professor Cleveland Abbe, of the Signal Office, is engaged in an extensive correspondence with old time telegraph operators for the purpose of collecting all possible information regarding the transmission of reports of the weather prior to 1860, which he intends to embody in an exhaustive history of weather telegraphy which he is writing. G. C. M.

Washington, Jan. 4th, 1889.

OUR LETTER FROM THE SOUTH.

Electric Lighting:—

An electric light plant will soon be erected at Rome, Ga.

Negotiations are being made at Marietta, Ga., for the erection of an electric light plant to cost $12,000.

Efforts are being vigorously pushed at Lewisburg, Tenn., for the erection of an electric light plant.

The Electric Light Company, at Annapolis, Md., are still receiving bids for the erection of their building, furnishing machinery, &c.

A stock company is being organized at McMinnville, Tenn., to erect an arc and incandescent light plant, and bids on machinery for same are wanted.

Mr. G. S. Alfred, of New Orleans, inspector of electric lights for the Board of Underwriters, is in Mobile examining the system of electric lights.

The Secretary of the Treasury has asked for an appropriation of $3,000, to erect an electric light plant at the United States marine hospital at New Orleans.

A. C. Green, of Fayetteville, Tenn., will erect an electric light plant at Columbia, Tenn., and is now negotiating for machinery. He will furnish power for the wire fence factory now in course of construction in Columbia.

Atlanta, Ga., is being supplied with 400 electric lights. The city will then be brilliantly lighted in every section. The lamps at the corners of streets are hung so as to throw the light in every direction.

A dissatisfied member of the Board of Aldermen, of the city of New Orleans, has just been thwarted in his efforts to annul the existing contracts which New Orleans had with the electric light companies. He claimed that a council had no right to take upon itself, and also future councils, a large debt regardless of financial or commercial circumstances; that the expense for electric lighting was out of all proportion to the revenues of the city.

His move to annul the contracts, however, was overruled. It was voted to recognize the contracts, and that the matter of proper lighting be referred to the committee on fire and lighting. E. A. O.

Charleston, S. C., Jan. 2, 1889.

OUR PACIFIC COAST LETTER.

Interesting Electric Light Station.—In view of the discussion following Mr. Leonard's paper on the use of petroleum as a fuel, the Los Angeles electric lighting station is quite interesting, since petroleum is used exclusively. The station was started in 1882 with two small engines and two 60-light Brush dynamos. From time to time additions have been made and during the present year two 18"x42" Hamilton Corliss engines made by the Hooven, Ewens & Rentschaler Company, of Hamilton, Ohio., of 200 horse-power each and running at 90 revolutions, have been put in, each driving three 60-light Brush machines. The dynamos are arranged so that all their pulleys are in the same plane, and the three belts run, one upon the other. The boiler plant consists of four tubular boilers of standard pattern and two Hazelton tripod boilers of 200 horse-power each, which furnish steam to the Hamilton Corliss engines. The aggregate horse-power of the boiler plant is about 700.

Petroleum as a Fuel.—The apparatus for burning petroleum under the boilers was thus briefly described to me by the pleasant superintendent of the station, Mr. G. W. Warren: The oil is stored in a tank eight feet deep and 12 in diameter, from which it is forced by a small steam pump under a pressure of 40 pounds, through the burners. These are of the Edmunds pattern in which a jet of steam vaporizes the oil, and two are placed under each boiler. The furnaces are ordinary, with a slight rise in the floor from front to back. Mr. Warren is very much pleased with the oil and says he would not return to coal even were it less expensive. He considers the heat more even and easier on the boiler than with coal. He has used petroleum exclusively for five years, and considers that he has given it a very practical test. The daily consumption of the station is 1,050 gallons. Mr. Warren in a test some time ago, found the consumption to average one quart of a 280 oil per horse-power per hour. Col. C. H. Howland is manager of the Los Angeles Electric Company, which operated this station and Mr. Blackmar is secretary. The city pays $25,000 per year for its street lighting, while the commercial rates are $3.50 per week for light until nine o'clock and $5.00 per week until midnight.

Telephone Service in Southern California.—The telephone service of Los Angeles and San Bernardino counties is in hands of the Southern California division of the Sunset Telephone-Telegraph Company, with headquarters at No. 17 North Main street. Here your correspondent found the genial superintendent, Mr. John Lawrence, who gave the following points about the system. The local exchange comprises now about 1,075 subscribers, whose daily calls average 13,000, or about twelve to a subscriber. They are connected to a multiple switchboard of just about this capacity, which requires seven operators. The county lines run to a second board called the "Sunset," which requires four operators. The number of subscribers is beginning to approach the capacity of the exchange, and the question will soon arise how to best increase it.

The Telephone Operating Staff.—The working force consists of one chief operator, thirteen day operators, one night operator and assistant. Mr. Howard Keyser is the efficient manager. The rates for offices are five dollars per month for less than 100 calls, and six dollars for unlimited switching; for houses one dollar less.

Principal Telephone Exchanges.—The principal exchanges in the territory included by the Los Angeles office are those at Pasadena and San Bernardino, each having 70 subscribers. The following towns have smaller exchanges: Colton, Pomona, Riverside, San Gabriel, San Pedro, Santa Monica, and every town in both counties, 50 in all, has at least one instrument. The longest line extends through the San Bernardino exchange to Redlands, a distance of 90 miles, and gives satisfaction with ordinary Blake transmitters.

New Electrical Organization.—Incorporation papers have recently been filed for the Rhodes & Keese Electric Company. The incorporators were: S. J. Keese, T. H. Rhodes, W. I. Keese, J. F. Cosby, G. Wiley Wells, and the Southern California Bank, treasurer. The company will do a general electrical business, paying special attention to electric lighting and bell work. They are agents for the Thomson-Houston systems of arc and incandescent lighting, the Hess Hotel annunciator and guest call, the Gamewell fire alarm telegraph, Bogart's electric gas burners, and Zimdar's pneumatic bells. Mr. Keese is president of the company and is a well known electrician, having been agent for the Thomson-Houston Electric Company for some time. The company will succeed to the business of Mr. T. H. Rhodes, at No. 20 South Main street, Los Angeles, whose reputation is supported by the many samples of his work to be found in this city and surrounding towns.

EDWARD G. THOMAS.

Los Angeles, Cal., Dec. 31st, 1888.

Telephonic News

*** Mr. Alexander McDonald has been appointed manager of the Decatur Telephone Exchange, in place of Mr. B. B. Grant, who died from yellow fever.

*** A hard-drawn copper wire has just been strung between Atlanta and Fairburn, Ga., a distance of 20 miles, but does not work well during the day, owing to heavy telegraphic induction lines.

*** Geo. H. Cole, superintendent of construction, Southern Bell Telegraph & Telephone Company, is making preparations to go to Richmond, Va., to put up two additional sections of switchboards for the exchange at that place, made necessary on account of continued increase of subscribers.

*** The annual meeting of the Northern Telegraph Co. was held in Manchester, N. H., at Gov. Smyth's banking rooms and the old board of officers re-elected as follows: President, ex-Gov. Frederick Smyth; clerk and treasurer, Hon. Chas. H. Bartlett; directors, Hon. Frederick Smyth, Col. John B. Clarke, Wm. F. Head, Esq. An annual dividend of three per cent. was declared.

*** The telephone in Atlanta is still gaining favor. Those who have done without it for years are gradually coming in. Long and patient work on the part of employés is proving much to their credit, and to the interests of the company. There is a great deal in silent but persistent efforts on the part of telephone employés. Several instances have occured where inspectors and linemen by their kind attention to subscribers have succeeded in satisfying kickers and persuaded them to subscribe for other 'phones instead of ordering out the ones they had.

*** The Western Union Telegraph Company have moved their Atlanta office into the Constitution building, occupying the entire third floor of the building for the operating room, and a large ground floor store-room for receiving room and manager's office. They have very fine quarters and the operating room is probably the largest and best arranged south of Washington, D. C. They have table and instrument accommodations for 100 operators, but are working only about 50 operators at present. The new room has been fitted up under direction of Mr. J. E. Fenn.

The New Telephone Building in St. Louis.

It has become fashionable for telephone companies of the larger cities to erect and own their own buildings. New York, New Haven and Chicago have buildings of their own. We present a view of the building proposed by the Bell Telephone Company of Missouri, which will soon be built in St. Louis. The architects are Shepley, Rutan & Coolidge, of Boston. The building is to be located on the southeast corner of Tenth and Olive streets, on the site of the old McCreery residence and the Scholten art gallery. The site is 50 feet on Olive street by 109 feet on Tenth street. The building is to be seven stories high, and of Kibey (Mass.) stone, rough dressed and fireproof throughout. It will present a very imposing and solid appearance. The cost will be about $125,000. The interior finish will be made to suit the tenant. The intention is to rent the first five stories and half of the sixth to one establishment. The executive offices of the telephone company will occupy the west half of the sixth floor, the elevator coming up from the rear on the Tenth street side. The seventh floor will be occupied exclusively by the telephone operating room. Work will be commenced at once, and pushed as rapidly as possible, though the completion of the building will probably require a year's time.

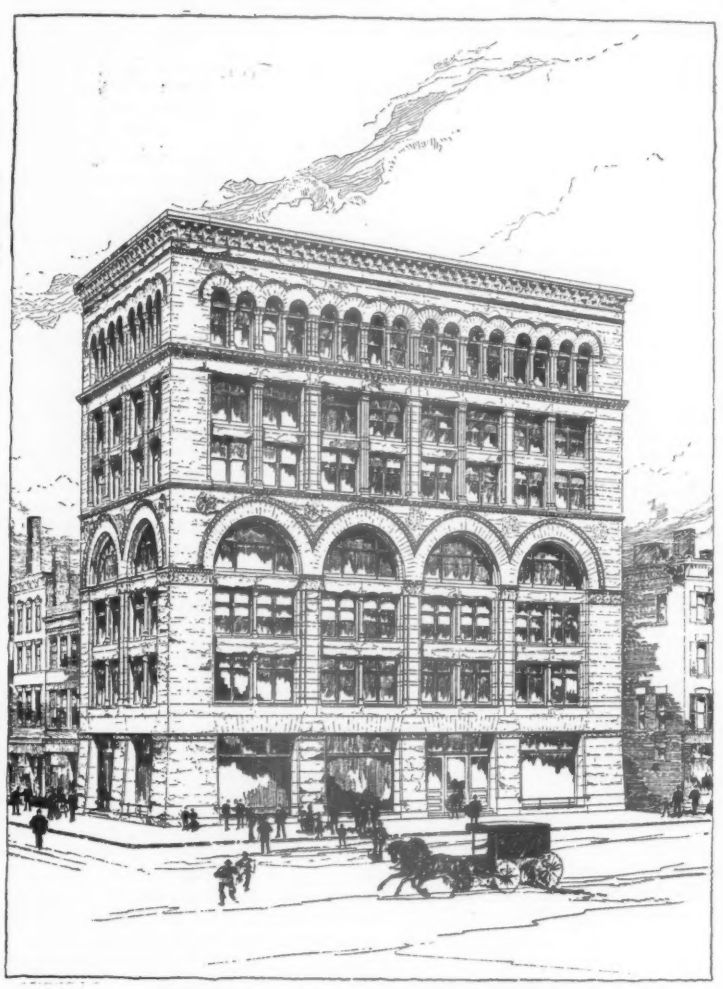
PROF. BRACKETT'S LECTURE.

(*Continued from page 3.*)

and set it going, and no work would be done in consequence of climbing up here or going down there. The floor above would also be an equi-potential surface, but the man who attempts to go up there will, of course, do work in going from one place to another. Now every one of the litile equi-potential surfaces about our wire are just exactly to each other as these floors are to each other. If we come from that card up to the next, we have to do some work, and the work is estimated in the same way as the work would be in getting from one of these floors to the other.

Now the cases differ only in the fact that the thing which produces it—notice carefully how I put this—it differs only in the fact that the thing which produces it in the one case is the current going through the wire, whereas in the other you have a great mass of rocks and material making up the mass of the earth. If we go from one of these earth planes to another we do exactly the same as we would in passing from one of these planes about the wire to another, only the lines which join these planes are said to be plumb.

If a current be passing in any given direction, say thus, it is accompanied by its magnetic field, consisting of circular lines of force and its radial planes, as we have seen; now, the theory of Maxwell requires that the strength of the induced spark was different from what it ought to be. He kept in mind that the adjoining side of the hall presented a large reflecting surface. If sound had been thrown on that it would have been reflected back. If a wave of sound struck on the adjoining wall it might be thrown off and give an interference, as two sounds not differing in pitch may give you absolute silence. He found that when he moved his apparatus from one position to another with respect to the wall, he could either cause the sparks to appear to disappear according to the relative distance at which he placed them. He thus found that his waves were about nine metres long. He calculates the time occupied in one oscillation, from the wave length and the known velocity of light, and finds that it agrees fairly well with the value calculated from the capacity and inductive capacity of the circuit employed. Now, how long are these light waves by means of which we can see? Divide your millemetre into ten million equal parts, take those as your units, write down point 588, and you have the wave length of ordinary yellow light. It is, therefore, inconceivably shorter than any distance that we are accustomed to measure, except by indirect trigonometrical processes. Now that is something like the wave length we want to see with, but the wave you get by Hertz's method is much longer than I can reach. When we can produce alternations of



THE NEW ST. LOUIS TELEPHONE BUILDING.

effects of any variation of the current, and so of the magnetic field, shall be propagated outward with the velocity of light, the direction of the propagation being at right angles to both the current and the lines of magnetic force so-called. Now, we are very near the end of this discussion, and have reached a part which I desire that you all catch hold of. Suppose, instead of having a continuous current passing down the wire, and having this magnetic pole revolve around it like this, we put in an alternating current. Then these circles are developed around the wire, but these circles are, in their tendency to carry the magnetic pole around current, reversed. When you have the current go up you have this movement (showing) and when it goes down you have this. Now, there is not simply one of these lines wound about the wire, but another and another and another, out as far as you please to go. The question now is how may we soonest pass from a position on one of those lines to one on another. We do it by a motion which is exactly at right angles to them as well as to direction of the producing currents, and an ether particle will vibrate in the same period as the current, and that vibration is light. (Prolonged applause.)

Now, I will go back again. Hertz found in a large hall where he carried on his experiments, that there were certain inference phenomena; for instance, the length and the current sufficiently rapid, we shall have the light we want without the production of an immense amount of heat which we do not want. Now suppose we had achieved that. A wire which is now a conductor and conveys a large amount of energy from one point to another would then convey just the form of energy we want, light would beam out from the conductor and you might handle it without any heat being perceptible. It would simply burst out with light and be a luminous thread running through the air. That is what electric lighting has to reach, or otherwise it will not be perfect. It is altogether likely that no conductors with which we are at present acquainted will suffice to transmit such alternations of current as we need. Langley's experiments on the moon show it sends wave lengths greater than those which come from ice, and you have not only those, but you have all grades of vibrations up to those which are away beyond all possible means of detection except by the most refined photographic processes, and in order to get what we want,—these miserable few vibrations suited to vision—we have to produce those altogether. As Professor Lodge has said, it is as if a man who wished to have less than one single octave must blow the whole organ at one time. That is what we do as a matter of fact. I now suggest one or two things that look hopeful. I am not afraid of giving this away, because I do not believe any of you will get up to-morrow and accomplish it, and I do not pretend that I see my way clear, though I tell you frankly I am going to experiment. Let us see what we can do. We can take an electric current and make it alternate—we can do that perfectly. We can make magnetic waves go back and forth and make the current alternate. Now what we may try to do is to take a beam of light which has a vibration already in parallel planes and harness that to a wire, so that it will make a current vibrate and also make the magnetic field about the wire vibrate. In other words, if you cannot do the sum, take the aswer and work it backwards. That is what I propose to do, and I will hint to you exactly how I propose to do it. It cannot be done with the ordinary materials employed for conductors if it has to heat the wire. The heat in the wire is most likely due to nothing else than a series of closed electric circuits in which the electric motion is around the molecular parts. We must get something that is not a conductor in the ordinary sense. I remind you that the amount of energy expended in the movement in the high vacuum tube, in the ordinary tube where you have the most beautiful illuminations, is as a matter of fact very small, since when it is properly managed, the amount of heat generated in it is very small. I point out to you next that there is one substance in which we have the properties of both the conductor and the non-conductor present and there are some very hopeful indications in that. A selenium cell which is semi-transparent when it is up-joined and a battery current is put through it, is found to have its resistance diminished immediately a flash of light falls on it. The question is, does its resistance diminish immediately, or is a force set up which conspires with the electro-motive force? I do not know which it is, but something may be advanced in favor of either view. Let us see how our problem works backwards. Suppose we make a polarizing apparatus by which we can polarize a long web of light. We could employ several glass plates. Let sunlight strike on this bundle at the proper angle and the light that is reflected from it is polarized. It will consist of vibrations all sorted out in parallel planes by themselves, so that they will not be fighting at cross purposes. Now let this long polarized web of light be passed through a narrow slit so as to pass directly upon, or near, the conductor in which we wish to set up an alternating electric current. If the proper conductor can be found, it should have the current set up in it and this should produce a magnetic field about it. If we put an alternating current through the conductor we shall get a series of alternating magnetic circular lines of force and light waves. Therefore if we take the latter right by the horns so to speak and apply them as an electro-motive force, we ought to be able to evoke the electrical current and the magnetic field at the same time. In other words those three factors being in existence, any two of them ought to be evoked by simply giving the one. That is what ought to be brought about; whether it will be brought about with conductors or with non-conductors I do not presume to say; but it will have to be done perhaps indirectly. The experiments of Hertz show that electrical actions can go on exactly like acoustic actions. The theory of Maxwell—and the experiments of Hertz confirm it—is that the actual wave of dynamic induction is at right angles in the lines of magnetic force, and to the electrical disturbance by which they are set up. Those waves differ from light by which we see, only in their lengths. They need to be shortened. What we want is an alternating current or discharge of some sort or other, which shall enable us to produce the alternations with such frequency that the so-called conductors will break out and shine directly. If we see no way of doing it at the present time, let us try to work the problem backwards by taking light from the sun and polarizing it and applying that to the conductor and so endeavor to set up in the conductor alternating disturbances which correspond with it in frequency so as to note their effect, and see if possible precisely what we have to do. A dynamometer ought to be constructed which would be capable of measuring the effect. But with the ordinary opaque conductor such frequency means confusion among the molecules which brings about a difficulty. That is what we must get rid of.

You have been remarkably patient and I beg you will accept my thanks for the way in which you have endured what I have said and for the courteous invitation you have given me to come here and talk. It frequently happens that one who can talk longest on a given subject knows the least about it. But I chose this subject with "set purpose and malice aforethought," not that I hoped to instruct you, but thinking that some one among you might catch an idea from my remarks and see that there were lines of experimentation which have not yet been developed and some of which I have briefly sketched. It seems a shame that we cannot have such vehicles as we choose—that we cannot get light without heat—that we cannot get the result we aim at directly with-

out the accompaniment of so much useless waste. You are burning up tons of coal for driving machines to no purpose whatever. When is there an end to be reached? In the light of the doctrine of the corrollation of forces and conservation of energy we should be able to reach the desired result with all simplicity. (Applause.)

Dr. Otto A. Moses: Mr. President, will you allow me—and I suppose I voice the feelings of all present—to thank Prof. Brackett for opening up a vast and a very new field for us to cultivate. I listened with a most rapt attention to what he has said, because some of his ideas there evolved are of the character such as Faraday could be credited with. He recalls the classical experiments, though neutral in their nature, of Faraday where he tried to corrolate the forces of gravity and electricity. I think Prof. Brackett has very well explained what escaped Faraday's most acute mind—the problem was so close to his eye that he couldn't see it. Prof. Brackett has also called attention to something, and as he has previous to his address invited from us discussion on it—in fact during his address he has said that we should interrupt him if we thought there was anything that required explanation—I feel as if I am not trespassing when I refer him to some experiments that have been tried in that direction, and which I am sure will interest him. In 1879, when Mr. Edison was experimenting on the incandescent lamp, I made a drawing of a vacuum tube containing a selenium conductor inserted into the side wall for the purpose of transmitting light from the point of production to an indefinite distance. The idea was an enticing one, and at all leisure moments I experimented upon it. In 1884, in the winter, the following experiment was tried by me, which I think will answer some of the questions that he has propounded: I took an Edison lamp and charged it statically from the dynamo machine, a continuous current machine, 110 volts E. M. F. I had a very beautiful display, a static discharge within the lamp that is known to you all. I approached my hand to that lamp and found that the luminous discharge followed the movement of my hand. I then conceived the idea of joining two such lamps, and at once jumped at the conclusion that it would be possible for me by applying my hand to the lamp nearest to me to produce a similar movement in this static discharge at the other end, and in that way transmit light so to say, or reflected light, or an influence upon light, to an indefinite distance. In my imagination I carried it still further. I said to myself that all points are at a different electrical potential. Prof. Brackett has very beautifully described what an equi-potential surface is. I thought that the bringing of an object in the neighborhood of that first luminous bulb would produce upon it a certain action dependent upon the equi-potential surfaces of the body brought near to it. The movement of my hand creates a corresponding movement in the luminous flash, *ergo*, the movement or presence of any body within, though the movement was not obvious to us, would produce a disturbance of that light corresponding to the disturbances brought into its neighborhood. The result was that at the very extreme of the line undoubtedly the same effect would be produced, so that I hoped to be able to transmit light to an indefinite distance in that way. I performed some experiments, I remember. Mr. Wetzler, of the *Electrical World*, was in the laboratory at the time, and I produced some curious effects. I had not time to carry out those experiments, but I can readily see they will lead to some results.

In order to return now to the subject of the evening, speaking of the operation of currents being able to produce those wave changes that would resolve themselves into light with the same heat that oscillations would be, we thus obtain a positive and a negative current that we might say, comparing it to an amplitude of movement, that whatever action was set up in the conductor would be a vibration at right angles to the axis of the conductor, in that way getting the impressions necessary to produce light. If we were to use an undulatory current which is rather slightly oscillating in its character, along a line of oscillations so minute and fine as to be apparently a continuous current, we would be better able to produce light from that than from these waves of vast amplitude in an alternating current. Now, what is the solution of the question? Might we not say where we get so much light with but little heat will come a solution of this question, and find in the using of currents of enormously high electro-motive force the solution of the question, instead of using one of an enormously rapid oscillation? But I will not trespass on the time of others. Those are merely thoughts which I have thrown out in obedience to Prof. Brackett's suggestion. (Applause.)

The Chairman: It has been suggested that we would like to hear from Mr. J. A. Powers, of Troy, on this subject. I believe he is in the room.

Mr. Powers: Mr. President, I think you have made a very unhappy selection, as I came in only in time to hear the latter part of the paper, or address. The subject is certainly a very interesting one, but one as to which I am sorry to say I am not competent to give any information or suggestions that would be of interest to the Club.

The Chairman: Gentlemen, the subject is open for debate, and I am sure that the Professor would be willing and only too happy to answer any questions that you might propound to him, to the best of his ability.

Prof. Brackett: If he can.

The Chairman: Certainly. It has been happily suggested that possibly the Professor can give us some information regarding the execution of criminals by electricity, which will be of considerable interest to us this evening. It has taken up a good deal of time lately on the part of the press and the electricians.

Prof. Brackett: Mr. Chairman, and gentlemen, the only experience I have had with the use of electricity in executing criminals has been in the class-room. I have about 150 papers that were written yesterday by students at Princeton, and I have not the slightest doubt that some of them will die in consequence. (Laughter.) Although the subject only remotely concerns electricity, I have some very decided notions though about the matter, and I may say at the outset that notwithstanding the fact that in New York it is the law that all persons convicted of offenses that are punishable by death are hereafter to be executed by means of electricity, my belief is that never a single man will die, except accidentally, by that means. I do not believe that New York will undertake to do so outrageous a thing as it seems to me that would be. The sensational character of the performance, and the degrading of an agent which has done so much and is accomplishing more for the advancement of civilization than almost any other in the history of the world, by applying it to such an ignoble use, and the uncertainty there is in the application of it, it seems to me are three very strong items against the attempt to so use it; and with all due deference to the law makers, it seems to me that some persons who were capable of giving rational advice in reference to the matter ought to have been consulted before the law was enacted. That is my feeling about the subject. (Applause.) I do not think there will be found anybody who will be willing deliberately to kill a human being with this instrumentality. They may kill dogs, and persons may lose their lives accidentally in the street, but with set purpose I do not believe it will be done.

The Chairman: I will mention, incidentally, here that the lecturer of the evening having given us food for the brain of an exhilarating nature, the board of managers have undertaken this evening, after we get through our discussion, which I hope will be prolonged, to furnish food for the stomach. In other words, we ask you, after the discussion is over, to adjourn upstairs, where there will be a little collation. But I trust that it will not interfere with any further debate on this subject.

Mr. Price: Before we adjourn, Mr. Chairman, I move that the thanks of the Electric Club be tendered to Prof. Brackett for his very interesting and instructive lecture tonight.

The motion being seconded, was unanimously agreed to.

Mr. A. V. Garratt: We have been kindly invited to ask questions, and I should like to ask Prof. Brackett what will probably be the importance, historically, of the Hertz experiments. As you know, the experiments of Young and Frinzel, on the properties of light in 1801, are regarded as great mile-stones along the road of scientific achievements. Last week the historian of the Boston Electric Club was asked to make a report, but was unable to do so because of the pressure of affairs; but he wrote to the club that this year of 1888 would become memorable in the history of electrical discoveries, more than for anything else, for these experiments of Hertz, and I think it would be valuable for us, if the Professor will kindly do so, to have him express himself on this subject; which I see he has refrained from doing, perhaps because he himself has been the first one to describe these experiments before an American audience. I wish Prof. Brackett would give us his views as to the historical significance of the Hertz's experiments.

Prof. Brackett: Gentlemen, it seems to me the position of affairs is about this: Before the experiment, which was almost an accidental one, by which the relation between the current and the magnet was brought about, the electricians of that age believed that they had finished with their art. They said in about so many words—the best of them—the subject of electricity is one of those things that the human mind now has got home with; there is nothing more to be done; the whole matter is closed up. Now let us see what happened. It is questioned whether it was not accidental, as much so as Galvani's original experiment. Here was a needle brought near a current. A law was found about it. Ampere took hold of it. A whole literature was created at once. Then men began to mouse around, and they found that some of these things had been reported before in a vague, indefinite way, and nothing had come of them. Henry, in 1832, found that a Leyden jar when discharged gave an oscillatory discharge back and forth. Later he published other papers in reference to it, down to as late as ten years afterwards. Fedderson worked on the subject, and several other men, and the whole matter of the oscillatory discharge was put beyond question. Now we find that at the late meeting of the British Association at Bath, men like Preece doubted very much the oscillatory character discharge, these recent labors of Hertz really begin with Henry's experiments. Now, Hertz has shown, as I have tried to bring out—I may have failed to make the impression that the only difference between these vibrations which he produced and these which are so excessively minute as to constitute visible light, is in the length. If, therefore, he had identified that kind of onward propogation which we call electrodynamic induction, if he has identified that with light, he has confirmed absolutely the theory of Clerk Maxwell, by which, starting with a few equations founded on electrical phenomena, he came out with those identical with Frenzel's, founded on luminous phenomena, so that we may see the object we are trying to reach, and if having clearly obtained sight of your port is not something in trying to get there—if that is not an epoch—I fail to see what would be. I think it is epoch making, when the electrician finds himself not merely putting things together and trying to bring something to pass by mere trial, but is working steadily towards a definite end in the future. From the matter having been in a certain jumble, we have a definite object before us; how can it fail to be accomplished? Now, on the other hand, Hertz ought not to be credited with everything. The fact is, Sir William Thomson comes in here, and the very mathematical work on which Hertz relied was his.

Dr. S. S. Wheeler: I would like to ask the Professor why the increasing of the induction of the Leyden jar decreases the time required for the discharge without the points being brought nearer together.

Prof. Brackett: The answer is simple, and Prof. Henry showed the principle involved. It is due to the self induction of the wires or the connections which run out to the sparking points. Suppose a Leyden jar charged. Now, if the discharge could be made infinitely short so that there would be no self induction in it, we should have simply the flow from the inside to the outside, whatever that would be, and the jar would be discharged. But I recall now one of Prof. Henry's experiments. He states it to be in about these words: When a small battery is moderately excited and its poles are connected by a copper wire not more than a foot in length, no spark is perceived when the connection is either broken or formed; but if a wire 30 or 40 feet long be used, there is a vivid spark on breaking. Now, the explanation of that is this. When rupture occurs we have the "extra spark," simply a spark that is due to a current which is set up in the wire itself by the action of one portion of the wire upon another. The consequence of that is that the wire itself not only discharges the jar but recharges it in the opposite direction. We have simply the action of the molecules to deal with, whereas, in experiments which *we* can perform, we have to do with the action of masses. In other words, to answer the question explicitly, because the whole charging and recharging due to the extra spark in the conductor is remitted to the action of molecules, we have turned it over to nature.

Mr. Garrett: Can I ask one very blundering question? I may not have got what was said, but I believe it was suggested we might work back end foremost, and instead of working in the line Hertz had been working in, we might place a conductor in a polarized light and thereby set up a condition of things which might make oscillations in the conductor from which we could derive light. But would that not take place of necessity in the day time. We do not want light in the day time, and that would give it to us, unless we run that conductor half way around the earth on the backside where the earth is in its own shadow.

Prof. Brackett: All I have to suggest is that when the sun shines in China it is dark in America. (Laughter.)

Dr. Moses: In a conversation with Prof. Brackett he called attention to the fact that among the animals in nature they have already some means of carrying on this enormously rapid vibration without the production of heat waves, so that you must not think that you have mere hypothesis in the air, for nature has done it on the most beautiful scale already, and we have only therefore but to interpret nature.

Prof. Brackett: Some years ago I had some luminous beetles, those large fellows from the West Indies. You could take one of them and hold it up and read a newspaper print without difficulty—I may say it was a good lamp and therefore offered a very good means of studying this matter. On bringing the spectroscope to bear upon it one kind of light only came from it. There was a band just at the junction of the green and the yellow; just the kind of light you would want to see with. Now on bringing the thermopyle to our aid there is no evidence that there is ever any more heat emitted from that object than there would be from any other insect of about the same size. He therefore is doing just the thing we want to do. He is making the ether wag at the proper rate, leaving all the other motions out. The problem, therefore, has been solved by nature, and it is incumbent on us to try to get its solution if we can.

Mr. E. M. Hamilton: I would like to ask Prof. Brackett one thing. I was, some years ago, in Central America and I found people there who were very confident that certain luminous bugs which they have there, especially a peculiar kind of very small insect, frequently set fire to their houses. Of course there is no truth in that—the Professor would deny that, of course?

Prof. Brackett: Assuredly.

Mr. Hall: I would like to ask Prof. Brackett if the experiments and investigations of Sorby and Becquerel in reference to fluorescence and phosphoresence, if that does not lie in the same line of thought, and if some of the very deep investigations and studies that they have made on that subject of fluorescence and phosphoresence would not have a bearing and value worth looking into upon this subject. Becquerel has, of course, made upon this subject quite a number of experiments upon the fluorescence of certain mineral substances, like gems, and so forth, some of them upon being heated are of full fluorescence and quite brightly so after the heat had passed.

Prof. Brackett: The answer, perhaps, will be suggestive of the way out of our difficulties. On introducing a cell of glass, containing a solution of esculin, into the eye piece of the spectroscope, we can extend the field of view a considerable distance beyond the violet. The reverse action is shown by certain substances, that is, they become luminous on being subjected to the action of waves too long for vision. What is the *modus operandi*? If I strike a piano forte string, say C in the middle octave, then certainly C in the next octave will be found to respond to it. If we set a string in one of the upper octaves sounding, the dampers being raised from the lower ones, we shall find that the corresponding strings in them also will sound. In other words, when the rate of vibration of one string is the multiple or the submultiple of the other resonance takes place. We can then accumulate the effects and find it is possible when using a wave length we do not want to get the one we want. Now suppose we are able to produce wave lengths that are sufficient to heat the body but are not sufficiently short to be seen. We throw them on a molecular structure and find that they make it vibrate with twice the frequency, then we shorten our wave one-half and the problem is so much nearer solution. Now it would seem to be quite possible to get wave lengths that are too long, which can be thrown on a substance which will vibrate in half their periodic time; such a substance might then become luminous.

Mr. J. B. Edson: Mr. Chairman, I simply wanted to ask the Professor if he was aware, whether or not, any measurements had been made regarding the presence of heat, we will say, for instance, in bodies of water like the Southern oceans, in which the phosphoresence is very visible, say, for instance, in the harbor of Rio de Janeiro, where the splash of the oars will frequently enable you to see it, or whether this is totally absent there, as in the beetle illustration.

Prof. Brackett: I only know, in a general way, that while it is true the water is of a higher temperature, it is not true that there is any such degree of heat as would be required by the hypothesis of combustion.

Dr. Wheeler: My question is somewhat similar to the last one, and I would like to know whether the Professor has made any comparisons of the amount of energy there is in a ray of ordinary yellow light and rays of light such as we get from gas, etc. We all know that to get light we have to generate a mob of miscellaneous rays of all kinds, and, as the Professor said, if we could get directly to the bull's eye of the rays we are looking for, without having a trail of all kinds of lower vibrations, it would be infinitely cheaper. I would like to know what is known on that subject—the comparative cost.

Prof. Brackett: I cannot give any data now, except in a very general way. The investigations of Maxwell led him to calculate the energy in a cubic mile of sunlight, and he gets at it in a very cute way. Now, it must be admitted that that is the same mob of which our friend speaks, all kinds coming together, rays that are too long and those that are too short, and the old distinction of these distinct properties transmitted by a luminous beam is all ruled out.

Mr. Hall: In addition to the scale of certain vibrations that are useless, the lower ones require a great deal more energy.

Prof. Brackett: Undoubtedly.

* * Brookline, Mass., is no longer at the mercy of the Boston and Albany R. R. It has an electric line now!

* * Franchise for electric or other railway from White Plains, N. Y., to Elmsford, on the New York and Northern Ry., 3 miles. The Board of Village Trustees, White Plains, N. Y.

* * Messrs. Chadbourne & Hazelton, Philadelphia agents of the Sprague Electric Railway and Motor Co., have just closed an important contract with the Reading Railroad Company, for the motors and dynamo to operate one of their large transfer tables at the Reading car shops. A short time ago, an equipment was sold to the Chicago, Burlington & Quincy Railroad at Aurora, Ill.; since that time, this new use for electric motors has been looked into and accepted by many of the railroads in the country. The Pennsylvania Railroad Company are equipping their large transfer table at the Altoona car shops with the Sprague motor, and this last order from the Reading Road makes the the third contract which has been given to the Sprague Company.

* * Mayor Hewitt finally disposed of the electric motor question, which has been agitated so long, by signing the resolution which passed the board of aldermen authorizing the use of the Julien motor on the Fourth Avenue line. As he had intimated before that he would do, he exacted from the railroad company important concessions by requiring the company to agree to relay their tracks with a new style of rail. An officer of the street car company intimated that this concession would cost them about $60,000. The Julien people are very much pleased with the result, and say that the railroad company's willingness to go to this large expense shows that they regard the Julien motor as being a great improvement over the old method of propelling their cars.

Electric Club Entertainment.

The following announcement, signed by Mr. Chas. W. Spear, secretary of the House Committee, has been sent to members of the Electric Club:

A lunch will be served at the Club House every Wednesday evening, beginning Wednesday, January 9th, 1889, at 7 o'clock.

The object of this being to promote a better acquaintance among the members of the Club, it is hoped that they will find it convenient to accept the hospitality of the Club on these evenings.

Get Ready for the Electrical Exhibition at Chicago.

The following circular has been issued by the National Electric Light Association, and should be carefully read by all who propose to exhibit at the Chicago meeting. The blanks alluded to below will be sent from the Association headquarters, 16 East 23d street, New York, upon request:

A large number of the representative manufacturers and dealers in the electric light and power apparatus and supplies have expressed a wish to the members of the executive committee and the officers of the Association, that facilities be afforded them to make a very large exhibit at the coming convention of the Association in Chicago, in February. So many have expressed themselves to this effect, that the executive committee has decided to secure a large hall where ample room for each exhibitor may be had.

Before the committee can proceed further with the matter, it will be necessary to know how many exhibitors there will be? How many square feet of floor space each will want? How many horse-power in steam? How many horse power from shafting? And how much current and at what E. M. F.?

For the purpose of the committee at present, it will only be necessary to have an approximate idea of what is wanted; therefore will you kindly fill out the accompanying blank immediately and forward it to Mr. B. E. Sunny, chairman executive committee, 148 Michigan avenue, Chicago, Ill.

The "Electric" Sugar Swindle.

The REVIEW has had its mails, for several months past, burdened with inquiries concerning the Electric Sugar Refining Company, which proposed to refine raw sugar as it never was refined, and at a cost far below any other process. Our answers have been, in the columns of the journal and by letter, that we had no faith in the scheme, and we have the pleasure of knowing that, in a few instances, at least, we possess the gratitude of investors who, being thus advised, did not invest in electric sugar.

Last Friday the scheme was shown up, the balloon punctured, and the stockholders made very unhappy. The price of stock dropped from $415, in London, to $60, and if you want to buy you can get it at your own price now.

The history of this sugar refining scheme suggests that other most successful and unique fraud, the Keeley motor and its dupes. Henry C. Freund was the pretended inventor, his discovery having been made some four years ago. Shortly after he had succeeded in forming his company and built his Brooklyn factory, in which was enclosed a private room visited only by himself, his wife, and another relative, he died, leaving the secret (?) with his wife. The daily press of New York, the financial papers, etc., were all filled with interest in the discovery, and the price of the stock increased rapidly, and everybody appeared to be on a rapid road to great fortunes. Still, the process was secret.

The people in the secret are, first, Mrs. Henry C. Freund, widow of "Professor" Henry C. Freund, the alleged German electrician and chemist, who died at 227 East Sixtieth street last March after inventing the alleged process; W. E. Howard, her stepfather, and his wife, Mrs. Freund's mother, and George and Gus Halstead, relatives. These five, with Jerry Flanagan, watchman at the company's "refinery" in Hamilton avenue, Brooklyn, were the only persons supposed to have knowledge of the alleged process. Flanagan, it is understood, has given evidence against the others. The president of the company is Mr. W. H. Cotterill, and the treasurer, Mr. J. U. Robertson, and the Electric Sugar Refining Company was capitalized at $1,000,000 in $100 shares. Prof. Freund's interest in the company was represented by 6,000 of the 10,000 shares. These were given to him outright, with the copper-fastened contract that as soon as a refinery was obtained and equipped he was to divulge the momentous secret. The remaining 4,000 shares were to be sold and the proceeds were to go toward the refinery and the machinery necessary to develop the new process.

Of these 4,000 shares 3,000 were sold in England and Scotland at and from par (£20) to £120. The other 1,000 shares were sold to American shareholders, among whom were Lawson N. Fuller, Wallace P. Willett, of Willett & Hamlin, and a score more of investors in lower Wall street. At one time the officials of the company in Wall street had $300,000 on hand, the proceeds of these sales.

The whole scheme, it now seems, was simply a process of manipulating refined sugar so as to make it unusually fine. Mrs. Freund and her associates have gone West, the secret room in the Brooklyn factory has been broken into and found to contain only the usual machinery for working up sugar, and everybody connected with the scheme, except Mrs. Freund and her friends, are inconsolably sad.

Thus fades away another gigantic swindle in which that potent word "Electric" proved to be the wool that covered the eyes of the investors.

The electric light companies in St. Louis have consolidated, the Thomson-Houston Company purchasing the plants of the other companies.

The B. F. Goodrich Company, of Akron, Ohio, have just purchased a 225 light Brush incandescent plant, and report that it is running to perfection.

Personal.

Mr. Thomas C. Perkins, of Perkins & Company, general electrical contractors, of Hartford, Conn., was a New York visitor last week.

Mr. Louis Glass, of San Francisco, is here in the interest of the Pacific Edison Phonograph Company organized by Mr. John I. Sabin and others.

Mr. Richard O. Heinrich, electrician with James W. Queen & Co., Philadelphia, was in the city last week, and paid the REVIEW staff a pleasant visit.

Mr. E. J. Anthony, of the auditor's department of the American Bell Telephone Company, was a New York visitor for a few days last week, *en route* to Louisville and Kansas City.

Mr. R. T. McDonald, Mr. M. M. M. Slattery, and Judge Taylor, of the Ft. Wayne Jenney Electric Light Company, are in New York, with headquarters at the Grand Central hotel and the Electric Club.

Electrician F. W. Jones, one of the best men of the fraternity, pronounces the plan of executing criminals by means of electricity proposed by the Medico-Legal Society as impracticable, and claims that the heart is more readily reached than the brain.

Mr. D. A. Andrew's name now appears in the changed name of the electrical supply company of Boston, which is to be known as Pettingell, Andrews & Co. Since entering the electrical business, Mr. Andrews has largely extended his circle of friends and acquaintances, and is building up a promising business.

Mr. Henry W. Pope, as business manager, and Ralph W. Pope and George H. Stockbridge as editors, have started a monthly journal named *Electric Power*, with an office at 150 Broadway. The first number was issued January 1. The REVIEW extends its best wishes, and hopes the new journal will receive its full measure of success.

One of the most complete and enjoyable banquets of the season given among the electrical fraternity was extended to Lieut. Frank Winship Toppan and his friends, on Friday evening last, by W. H. Johnstone, Esq., president of the American Conduit Company, at the Hotel Brunswick, this city. Mr. Johnstone's fame in that direction has never been equalled, to our knowledge, by but one connoisseur and that was the late Sam. Ward.

Col. Gardiner C. Sims, the popular engine builder, of Providence, R. I., was a visitor in the metropolis over New Year. In addition to his engine business the genial Colonel has large lumber interests, and is actively interested in the Tunis-Sims Lumber Company, which owns extensive forests in the South, and has recently contracted for a large mill near New York.

Mr. David B. Sickles, a gentleman possessing many friends in electrical circles, associated in business with Mr. Henry D. Lyman, the well-known member of the Electric Club, is spoken of in the *Daily Graphic* as follows: "One of the busy men of New York is David B. Sickles. He is treasurer of the American Surety Company, of which he was one of the originators with the late Richard A. Elmer. He is vice-president of the Twenty-third Ward Bank, a Harlem institution of which he was the founder; president of the Harlem Republican Club, and prominent in Y. M. C. A. work there. He finds time, in addition to these duties, to make an occasional effort in the lecture field. On Saturday night he delivered a lecture in the free course at Cooper Union, on 'Siam and the Siamese,' a subject with which he is thoroughly familiar from several years' residence at Bangkok as United States Minister. American influence in that kingdom has led to direct civilizing results, and the Siamese regard Americans as the greatest people on the face of the earth."

*** In accordance with the decision of the United States Supreme Court, the Pan Telephone Company of St. Louis, Mo., turned over to the Missouri Bell Telephone Company all of their telephones, which were cremated in the furnaces of the Chamber of Commerce building, December 27.

The next Electric Club Lecture.

On January 17th, the regular monthly meeting of the Electric Club will be held and the address of the evening will be delivered by Mr. E. N. Dickerson, the eminent patent attorney, one of the early members of the Club. The announcement that Mr. Dickerson will speak is sure to bring out a very large attendance. The subject is "The Steam Engine," a topic that will especially interest the electric lighting and electric power representatives of the Club. Mr. Dickerson has found time in his busy life to devote a vast amount of study and research to the development of the steam engine, and the large audience that is certain to be present may be assured of a most instructive and valuable evening.

Thanks Awfully; but We Prefer our Own Name.

Reprinting a recent leader of ours, entitled "Electricity our Defence," the ELECTRICAL REVIEW of New York reproachfully reminds us that the title we borrowed, with a compliment to the "American press" for its felicity, was the REVIEW's very own, adding these significant words, "The name of this journal is not the 'American Press.' Does our neighbor see the point?" If our neighbor will pardon us for saying so, we rather think there is more handle than point to this complaint. We certainly paid a high compliment to the newspaper in question—much higher than if we had mentioned it by name. On reflection, probably, our contemporary will see the point of *that* remark.—*The Electrician* (*London.*)

Manufacturing Notes.

Nearly all the electrical manufacturers report a splendid business for the beginning of the new year.

The Phœnix Glass Company of New York recently shipped a large quantity of their finest arc and incandescent lamp globes to the Tokio Electric Light Company, Yokohama.

The E. S. Greeley & Co., are out with a very beautiful calendar, in which the artistic taste of the discriminating veteran Goodyear is very evident. The calendar is one of a kind that everybody will want and will save.

Messrs. H. E. & C. Baxter, 18 Fulton street, Brooklyn, are meeting with that success that naturally follows hard work and an intelligent understanding of the wants of the trade. Their business of manufacturing electrical supplies is constantly increasing and extending over the country.

The incandescent systems are seemingly growing in great favor on the Pacific Coast. The *Lumberman and Contractor* says that with the beginning of the year we look for great activity in introducing the different incandescent systems, especially the Thomson-Houston, Waterhouse, Westinghouse, the Fort Wayne Jenney (Slattery Induction), the Ball and the Mather.

The John A. Barratt Battery Company, of Baltimore, Md., (410 West Saratoga street) has been organized to manufacture the dry cell chloride of silver batteries, invented by that very capable young electrician, Mr. John A. Barratt. The officers of the company are named as follows: J. A. Pfarre of Geo. Tiemann & Co., president; R. P. Barrett, vice-president; Claude Van Ribber, M. D., secretary; Geo. Franke, treasurer; Charles Willms, general manager; R. P. Barrett, electrician; John A. Barratt, consulting electrician.

The Schenck Belt Holder and Shifter Company have received numerous testimonials regarding their devices, among them from the S. S. White Dental Manufacturing Company, Princess Bay, S. I., this belt running a double acting gas compressor, 550 pounds pressure to the square inch; the Clifton Manufacturing Company, Clifton, S. C., belts driving two 30 horse power Edison dynamos; Alfred Dolge, Dolgeville, N. Y.; Thomson-Houston Electric Light and Power Company, Buffalo, N. Y., two machines, 53 x 10. The Schenck Company received the "Excellency" medal at American Institute Fair, recently held in New York city.

Johnston Electric Train Signal.

With the heating of cars by steam, and lighting by electricity, came the need for better and more efficient means of communication from any part of the train to the engineman's cab. Several electrical devices to effect this result have been tried with greater or less success, an important condition being absolute reliability, effected largely by a perfectly dust and cinder proof apparatus. Any successful system must also be so arranged as to ring an alarm automatically should the train become parted from any cause. Patents have recently been issued to the Johnston Electric Train Signal Company, on the system illustrated in the accompanying cut, which, it is believed, meets all the requirements and overcomes any difficulties in the way of a successful electric signal system for railway trains.

The cut shows the coupler between the cars as it appears when coupled together, also the parts when uncoupled. The cable, as shown, with the button on it, represents the wires (covered) as they appear extended through the car. The wires are thoroughly insulated and woven into one cable about the size of the ordinary bell-rope, and the so-called push-button or point of contact, is a very neat globular shaped device spanning the cable, and by a pressure upon one side the contact is made. At the same time the pressure creates a friction upon the two points of contact that polishes them bright and prevents the current being cut off by corrosion. The button is also sealed, making it dust and water proof. In making the connection between the cars the wires are brought together with a friction that removes all dust or corrosion, and, as in the case of the button, it keeps the points of contact bright and clean. When the coupler is pulled apart the circuit is closed automatically, causing the bell in the engine to ring until shut off. It can be applied to both passenger and freight cars. In applying it to the latter the signal is so constructed that if the train breaks apart a bell will be rung automatically both in the engine and caboose. That part of the cable between the cars which is exposed to the weather is protected by rubber tubing fitted into the coupler and extending under the bonnet of the car.

The cable is fitted to each car and is not removed, thus preventing the breaking of lamp shades and door glass. A battery placed in the engine cab operates the entire system. The apparatus is shown in working order at the company's offices in the Equitable Building, Boston, and will soon be given practical tests on one or two railroad systems.

The New Stations of the Edison Company in this City.

It is something over six years since the business of incandescent electric lighting on the Edison system was begun in the down-town districts of the city. September 4, 1882, a station was started at Nos. 255 and 257 Pearl street, and it has been running night and day ever since. The electricity has been furnished through 56 miles of underground wires, and is now supplying 15,000 lamps.

In the up-town districts about 165 miles of conductors have been laid, and two new stations are practically complete. The buildings are exactly alike, one in Thirty-ninth street, near Broadway, and the other in Twenty-sixth street, near Sixth avenue. As they are in a good part of the city, they are somewhat ornamental in design, and the fronts are of brick, with granite trimmings, the exterior showing very little of the purpose for which they are intended. The walls are four feet thick, and everything possible has been done to make the structures fire-proof. In a total cost of $135,000, the contract for the carpentering, glazing, painting, etc., was only $4,000. The floors and roof are of tiled arches, the stairways are stone and iron, and the side walls are lined with glazed brick. Two immense stacks in the rear supply the draft for the boilers, which is remarkably good.

The engines, manufactured by Armington & Sims, of Providence, are on the ground floor, and they are built in such a way as to be entirely detached from the main walls of the building, so that there is no vibration. When the capacity of the buildings is reached, there will be 14 engines in each, and each engine will run two dynamos, making 28 in all. Running under the most economical condition, 250 horse-power will be developed, or about 4,000 horse-power combined. The pumps are also on this floor, and they are in duplicate. The supply wires come in from the street, and are carried along the walls to the dynamos, which are on the second floor. There is room here for 28 dynamos, each capable of supplying light for 1,250 lamps of 16 candle-power. It is calculated that when all are running, 40,000 lamps can be supplied at one time, and, according to the average use, 100,000 lamps can be placed in a circuit. The dynamos are run in pairs, and four pairs have been put in place ready for use. The others will be put in as the demand for them necessitates. Between the dynamos, which are on each side of the building, is the regulating apparatus. Within a space eight feet square the supply of electricity running from the full number of dynamos can be regulated to a nicety. The tests applied are so delicate that the current sent over one wire can be small enough to keep only one lamp burning at its normal rate, while the wire beside it may be supplying 1,000 lamps.

—— J. S. Tutthill, representing the Waterhouse system, is putting in an electric light plant at Ashland, Oregon.

—— The harbor commissioners of San Francisco, Cal., awarded the contract for lighting the water fronts to the Electric Improvement Company. There are to be twelve 2,000 candle power lights, and the price $3.50 per week each.

—— The contract for lighting the town of Harrison, N. J., with electricity, from March 1st next until March 1st, 1894, was signed last week, President Rice and town clerk Grace signing on behalf of the town, and Seabury & Johnson on behalf of the Harrison Electric Light Company. The company has opened an office at 302 Harrison avenue, of which William H. Hutchison, formerly of the staff of the *Journal*, is manager.

—— Carthage, Mo., December 26th, 1888. The newly incorporated electric light and power company have completed their plant, consisting of a 110-horse-power, Beek's patent stationary engine. The placing of the plant, including the Sperry electric dynamo, was completed by W. B. Myers, superintendent of the company. This will give power to run 100 lights.

—— The Edison Illuminating Company is now prepared to furnish light for 2,000 lamps from the Thirty-ninth street station, by the two dynamos which were started last week, and in a few days the capacity will be largely increased. The company taps its subway in the same way as a gas or water main, carries the conductor to the inside of a building and puts in a meter without cost to the consumer. The wiring of the building is done at the expense of the owner or lessee. Not a foot of wire belonging to the company is above ground, and subways are built as needed in the development of the system. Many private houses have been lighted by the company for some time by means of small dynamos, which have been running until the others are ready, but their use will now be discontinued.

An Electric Christmas Tree.

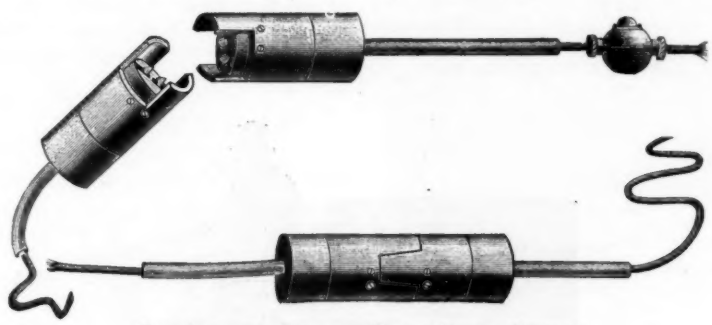
By means of 21 storage battery cells and 130 Edison lamps of 6 candle power, the Christmas tree of the children's festival, at Christ Church, corner of Clinton and Harrison streets, Brooklyn, was electrically illuminated. Each lamp was permanently mounted in a metallic star which acted as a reflector. Mr. Frank A. Perret, of the Elektron Company, had charge of the electrical work on the tree.

—— The Willamette Falls Electric Light Company of Portland, Oregon, has replaced its old plant with Thomson-Houston machines.

—— Two dynamos for the Citizens Light and Power Company have arrived at Burlington, Vt. All work is being pushed, and the new electric plant will soon be in operation.

—— The Brush Electric Company, of Cleveland, Ohio, has recently received an order for a machine having a capacity of 30 2,000-candle-power lamps, and a full complement of lamps for central station lighting. The order came from Mexico.

—— At Vancouver Barracks, W. T., a contract has been entered into with the California Electric Light Company for an electric light plant of forty-five lights of 1,200 candle-power at a cost of $8,100, the plant to be in operation by February 1st.



THE JOHNSTON ELECTRIC TRAIN SIGNAL COUPLER.

—— The Edison electric light plant at Victoria, B. C., has recently been enlarged by adding an Armington & Sims engine, and 1,000 additional incandescent lamps with dynamo. Mr. Hutcheson of Barrs, Montreal, was engineer in charge of the work. Thomas Carson is manager of the company.

—— The Quincy, Mass., Electric Light Company, has voted to increase the capital stock from $35,000 to $60,000, in order to supply the demands on the company for more light. The company expects not only to supply the additional arc and incandescent lights already applied for, but also to furnish power to operate the street railways.

—— At Toledo, Ohio, recently, the city council wrestled with the question of putting up the electric light wires, and finally referred the whole matter to a special committee, consisting of City Electrician McNamar, Chief of Fire Department Nagley and City Civil Engineer Wickenden. The question of insulation apparently bothers the councilmen—and they have lots of company.

—— President M. J. Francisco, of the Rutland, Vt., Electric Light Company, replies to an anonymous writer in one of the daily papers there, and after showing the fallacy of the correspondent's logic, he says: "No enterprise started in Rutland has benefited the people more or given the place a better reputation abroad than the electric lights; and the entire funds to establish and maintain the same have been furnished by its citizens. Still, there is a clique or set who have done, and are doing, all they can to injure and embarrass the company, and to prevent its stockholders receiving a fair interest upon the money they have invested in the business, and in their endeavors to build up the place. What inducement can capitalists from other places have for establishing their business here, when they see such efforts made to destroy the business of its own citizens?"

ELECTRIC LIGHT NEWS

—— The average price of gas in London is 66 cents per 1,000 cubic feet.

—— The Decatur, Ala., Electric Light Company will enlarge their plant.

—— D. P. Carson, McMinnville, Tenn., wants proposals either arc or incandescent.

—— The Annapolis, Md., Electric Light Company, is looking for proposals for a plant.

—— At East Hampton, Mass., the electric light system was put in successful operation for the first time, December 31st.

—— Chicago puts on airs with her new electric lights. She is truly proud of the improvement thereby made in her appearance.

—— Proposals are wanted for lighting the public streets at Nashville, Tenn., for a term of three or five years. The Mayor of the city may be addresed.

—— The electric light plant of Plattsburgh, Vt., has been purchased by a syndicate of business men who are to put in an incandescent system.

—— The San Francisco, Cal., Electric Improvement Company has installed a 250 incandescent light plant in Santa Clara, the Slattery system being used.

—— The electric light plant at Orange, N. J., is having its capacity doubled. The citizens of this beautiful suburb are large patrons of the electric light.

—— The Westinghouse Electric Company intends to manufacture all its cut-outs from porcelain hereafter, and has placed a battery furnace in its Pittsburgh building.

—— The Russell Electrical Manufacturing Company, Providence, R. I., has perfected a device for suspending arc lamps over streets, midway between the curbings.

—— The Union Ferry Company, of Brooklyn, have contracted with W. & A. Fletcher, of Pittsburgh, Pa., for a steel ferry boat to cost $120,000, and to be lighted with electricity.

—— The Duluth, Minn., Electric Company has ordered its Jenney arc plant. The utmost dispatch will be used in getting it ready to light the city. 125 lights will probably be used.

—— Frank H. Prince, of Chicago, electric light inspector, received a shock that tumbled him off of a 12-foot ladder. He had carelessly touched a naked wire, and received a severe shock.

—— Green Bay, Wis., is to have an electric street railway, S. A. Douglas of Green Bay, and R. H. Pierce of Chicago, having obtained a charter and filed a bond of $10,000 as a guarantee.

—— The Central Railway Company of Sacramento, Cal., is putting up a power plant. The storage battery car is running with such satisfaction that others will be ordered at once.

—— The public streets of Liberty, Mo., are to be lighted by electricity and the question of a suitable system is being discussed by the city trustees. The clerk of the board may be addressed.

—— The new U. S. coast defense vessel, the plans of which have been perfected, will be furnished with dynamos of sufficient capacity, and of most modern style, for search lights and lighting vessels throughout.

—— The Fall River, Mass., Electric Light Company, voted to increase their capital stock from $60,000 to $90,000. The plant is being constantly improved and enlarged with a view of lighting the city on a larger scale.

THE NEW YEAR.

The Electrical Fraternity Make a General Resolve to Change for the Better.

A FEW OF THE REMARKS RECORDED BY THE "REVIEW."

There is always an interest in the personnel of the advocates of reform, and the REVIEW, by means of the long distance telephone, the ever reliable telegraph and the reporter's imagination, has secured a list of reformer's names that is worthy to be chronicled for the benefit of all future members of the electrical fraternity. Some may fail in carrying out their resolves, but we think the average will be high, and do not think any other industry or science can compare with electricity in this respect:

George F. Durant: Did you read that telephone decision?

F. G. Beach: Chicago is a good town, but New York is better.

Albumum Brighton Uline: Never say election to me again.

H. M. Linnell: I shall let Columbus's bones rest in peace hereafter.

Marmaduke M. M. Slattery: I will never invest in another Louisiana lottery.

Geo. L. Beetle: This to be a great reform year—after the Chicago convention.

H. Laurence Storke: I am awful glad that Sabin didn't take up that election bet.

H. Matrimonial Harding: I've sworn off on a single life—the Benedict is the man for me.

C. D. Crandall: Since the rise in real estate I have stopped thinking of leaving Kansas City.

Col. J. J. Dickey: I will never decline to go to New York again. It is the Omaha of the East.

Thomas Bayard Doolittle: I have forsworn politics. The country may go to the bow-wows.

James Kempster: I shall be a happy man if I don't back up against a hot steam pipe during 1889.

Commodore Schuyler: My next yachting party must be composed of gentlemen who possess sea-legs.

J. P. McQuaide: I shall respectfully but firmly decline to enter any more athletes in walking matches.

M. W. Goodyear: Elections should never be celebrated until the next day in these uncertain political times.

Chas. Dutton: As long as I live I will never again say anything about "curing all ills that flesh is heir to."

Cyrus O. Baker, Jr.: My friends having generously sent me quantities of dog-bite cures, I am better now.

John W. Beane: Having tried 893 cures for rheumatism, I have sworn off trying any more—the rheumatism I still have.

H. A. Cleverly: I shall never stop giving my staff Christmas turkeys—from superintendent to errand boy. They deserve it.

Hand-me-down Dwight Stanley: The next time I set up all night to paint stripes on a suit of clothes it will be a cold day in July.

Fred. W. Royce: From what I hear of the New York inauguration electrical crowd guess it will be well for me to disappear March 4.

John I. Sabin: I'll swear off on Toppan. There are times when I must sleep—that's where he and I differ! Oh, those Welsh rarebits!

W. J. Hammer: The Edison display at the Paris Exposition this year will excel all my former efforts, or I'll never return to the United States.

W. H. Johnstone: Wagers with Toppan must be made but seldom. There has been a famine at the Hotel Brunswick since I paid that dinner bet.

Dr. Otto A. Moses: There is such a thing as a son stealing his father's thunder; I have decided to watch that son of mine more closely hereafter.

Fire Brand Knight: I will never burn another telephone. This thing of being called the "Telephone Incendiary" is becoming monotonous.

L. H. Korty: Now that I have sworn off on politics, think my Republican friends should let a stricken Democrat like me alone. They should be "magnemonious."

Brig.-Gen. Gardiner Climax Sims: Every time I tell a war story the boys raise my military title, therefore I have hopes of becoming commander-in-chief of all the armies.

E. G. Acheson: Under the inspiration to be found in the quiet hours at the Electric Club, I have been able to prepare the longest lecture effort of my life, and start in the new year rejoicing.

Solomon Bryan: As all my election prophecies came true, will just take a hand at politics again in four years. Still, to reside in Washington where you can't vote, is somewhat restrictive, I must confess.

A. H. Patterson: I have sworn off on entertaining strangers unawares thinking they may be angels, and the next time Baker and Spear appear in disguise as purchasers I will send them to Washington Market.

Actor Charles Stevenson: If I invite a party of friends to an Electric Club dinner, and then get the dates mixed again so that two dinners have to be accounted for when only one was enjoyed, I may be put down as the "man without a memory."

George L. Phillips: I always did like the telephone business; and of late my cup of joy has been entirely full. I know when I have had enough, so no additional telephone presidencies this year for me—two are sufficient for present exercise.

A Very Excellent Telegraph Brigand.

Some of the fresh daily papers having accused Mr. Erastus Wiman of being a "telegraph brigand," he pauses to reply as follows

"Any man that can in seven years pay a million and a quarter of dollars, equaling eight per cent., while but for him the thousand shareholders interested would never have received a dollar, is a handy kind of brigand to have around. If for the future he can, on the one hand, continue to pay six per cent. in the face of the fiercest competition, while, on the other, without this instrumentality disaster and ruin will overtake the properties concerned, this is a species of brigandage which, if universal, would make the monetary millenium much nearer than at present it appears to be."

—— The city of Nashville, Tenn., will receive, until 3 P. M., Thursday, January 31st, proposals for furnishing from May 1, 1889, for a period of not less than three nor more than five years thereafter, arc lights of 2,000 standard candle power. By addressing Board of Public Works and Affairs, all information desired by bidders can be obtained.

Our Medico-Legalites Furnish Amusement for English Electricians.

The solution of the problem of how best to apply electricity for the happy dispatch of criminals in New York was undertaken some weeks ago by the Medico-Legal Society, which appointed a committee of four gentlemen to report upon the most suitable method of putting the new law into practice. We do not know whether much interest is manifest in this country on the subject, but at all events the following extract from the report will cause some amusement amongst our own fraternity:—"There are several points requiring thoughtful consideration in the application of death currents to man, which we now proceed to lay before you. The average resistance of the human body is about 2,500 ohms. The most of this resistance is in the skin. It it evident, therefore, that the larger the surface of the electrode applied to the body, the greater will be the resistance. It is also a fact that the density of the current depends upon the superficial area of the electrode. A pole of small diameter will hence meet with less resistance, the passing current will be more intense, and the resulting current strength will be greater than when an electrode of large sectional area is applied." Dr. Stone will doubtless be able to appreciate to the fullest extent these remarkable conclusions of our American cousins.—*London Electrical Review.*

A Carriage Call.

The illustration herewith shows the so-called Lee "carriage phone" in use. The passenger calls the driver by means of a mechanical gong, and then gives orders through the "phone" as indicated in the cut. The E. S. Greeley & Company are handling the call, and have already placed a number of them.

A Decision Against the Gas Light Company.

Judge Ellis, section A, civil district court of New Orleans, rendered a decision in favor of the city in the case of the New Orleans Gas Light Company *vs.* the City of New Orleans *et al.*, to annul the city's contract with the Louisiana Electric Light and Power Company. The suit was brought on the grounds that the contract was void, for various reasons set forth in the petition. The judgment was in favor of the city, on the grounds that under section 7 of the city charter (act 20 of 1883) the city council has the power, and it is made their duty, to pass such ordinances and see to their faithful execution as will materially benefit the city and its adjuncts. Acting under this and other parallel ordinances, the city contracted with the Louisiana Electric Light and Power Company to furnish light at specified rates and locations, for five consecutive years, commencing January 1, 1888, payments to be made monthly, and as this contract is in compliance with the laws set forth in the city charter, it cannot possibly be broken.

—— Bidding for electric lights for the city of Philadelphia is reported as follows: The prices average about 2½ cents less per night than the past year; Germantown Electric Light Company, 55 cents a lamp; Frankford Electric Light and Power Company, 55 cents; Northern Electric Light Company, 48 cents; Brush Electric Light Company, 45 to 50 cents; United States Electric Light Company, 49 cents; Philadelphia Electric Light Company, 45 to 47½ cents; Wissahickon Electric Light Company, 55 cents. The companies do not conflict in territory and all will probably receive contracts.

A Promising New Storage Battery.

That Boston is doing its share in the march of electrical development is brought to mind almost daily. A recent trip of investigation revealed an interesting example of electrical progress. It was the Johnson storage battery, a new form of electrical reservoir, which bids fair to take a very prominent place in this line of business. Without going into the details of construction, which have been carefully worked out by Mr. Johnson, and are the fruits of long study and experimenting, it may be said that this battery has claimed for it the following advantages, which a careful investigation seems to substantiate. It has an increased mechanical strength. Its form and arrangement are such that the active material is held firmly in place, preventing its becoming detached from the plate. It also shows a greater per centage of the active material to be utilized, and after six months trial the plates show no tendency toward buckling or sulphating. The battery may be charged at a high rate, 50 amperes being so employed at the time of visit on cells whose plates were 5¼ x 5¼ inches.

Twenty-two of these small cells later gave current to twenty 45-volt lamps (1.1 amperes), and 10 of the lights were thrown off and on without any appreciable change in the brilliancy of the remaining lamps. The experiment was then tried of cutting into 10 cells with four 20-volt, 3 ampere Bernstein lamps in multiple. Even while the twenty 45-volt lamps were burning, the Bernstein lamps were cut in, and still there was no appreciable diminution of brilliancy. A unique feature of the arrangement of the cells was the wooden stands on which they were placed. It was supported on glass castors and glass plates were used above, the shelves being thus removed from outside connection.

To demonstrate the adaptibility of the battery for other purposes, three small cells, composed of one positive and two negative plates, each 5¼ inches square, have been connected in an ingenious manner with a a large signal bell weighing over 100 pounds. These cells are charged by utilizing the current of one lamp, and thus perform the work of striking the bell, for which 11 large Bunsen cells are required in ordinary practice.

The company which is to manufacture this new storage battery has leased a portion of a large building on Mt. Washington avenue, and will soon be in a position to manufacture them and fill a number of orders already in.

Be Careful at the Telephone.

Ladies, particularly married ladies, should be careful how they talk through a public telephone when the instrument is exposed so that what is said may be heard by others. To be sure, only one end of the conversation is heard; but even that much is often enough for one to get at the pith of the subject. We have an instance in mind now. While waiting for a car in a down-town drug store a stylishly-dressed young lady of about 25 entered, accompanied by a gentleman a few years older. The couple stood and looked out of the window a few minutes, and then the gentleman whispered to his fair companion, who, after a little hesitation, asked the druggist permission to use his 'phone. It being given her, she rang up the central, went through the usual formula, and then was heard the following: "Hello. Is that you, Willie?" "Yes, it's me." "Say, Willie, Nellie wants me to take supper with her, and I want to go." "Yes, at her house." "And say, Willie," this in a soft winsome voice, "you don't care if I don't come right home, do you, dear?" Here her companion looked anxious, pulled his mustache and rubbed his leg with his foot. The young lady continued; "Oh, no, dear, I shan't be long." "How?" "O—er—not later than 9 or 10 o'clock, dear. You don't care, do you?" "Well, if you care, I won't go. But you don't care, do you, dear?" "Thank you, dear. Good by." Her companion looked happy now, and smiling and chatting gaily, they walked away towards Nellie's.

ELECTRICAL PATENTS

INDEX OF INVENTIONS FOR WHICH LETTERS PATENT OF THE UNITED STATES WERE GRANTED IN THE WEEK ENDING DECEMBER 25, 1888.

395,260 Armature for dynamo electric machinery; Warren S. Belding, Chicago, Ill.

395,299 Electric motor; Daniel F. Sweet, Grand Rapids, Mich., assignor to Marcus W. Bates, same place.

395,311 Insulating support for secondary battery electrodes; Henry F. de Cameron, Detroit, Mich., assignor to the Woodward Electric Company, same place.

395,315 Electric signaling apparatus; John P. Coleman, Swissvale, Pa.

395,317 Sign for electric lights; Edward A. Dubéy, Brooklyn, N. Y., assignor of one-half to Thomas B. Rutan, same place.

395,363 Machine for covering wire; Henry Splitdorf, New York, N. Y., assignor to the Splitdorf Wire Company, same place.

395,377 395,378 395,379 Secondary battery charging; Charles F. Brush, assignor to the Brush Electric Company, Cleveland, Ohio.

395,399 Lightning rod; Louis L. Mast, West Milton, Ohio.

395,421 Safety device for use in electric circuits; Arthur C. Cockburn, London, England.

395,427 Automatic telegraphy; Patrick B. Delaney, New York, N. Y.

395,442 Conduit electric railway; Byron Jennings, San José, Cal.

395,476 Speaking telephone; Francis Blake, Weston, Mass.

395,488 Manufacture of electrotype or stereotype plates; James Dale, Chicago, Ill.

395,508 395,509 395,510 Multiplex telegraphy; Francis J. Patten, New York, N. Y.

395,524 Electrically operated cutting device; Russell Thayer, Philadelphia, Pa.

395,533 Automatic safety cut-out for electric circuits; Granville I. Woods, Cincinnati, Ohio.

395,546 Electric cable; William A. Connor, Pittsburgh, Pa.

395,556 Vibratory multiplex telegraphy; Stephen D. Field, Stockbridge, Mass.

395,575 Electro-magnetic rock drill; Harry N. Marvin, Syracuse, N. Y.

395,584 Conduit for electric wires or cables; Edward H. Phipps, New Haven, Conn., assignor to Edward S. Perot and James P. McQuaide.

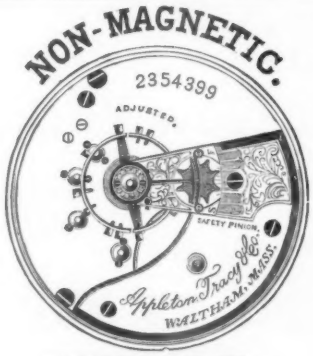
395,609 Electrical switch; Paul H. Brangs, Newark, N. J., assignor to the United States Electric Lighting Company, New York, N. Y.

395,613 Electro-harmonic telegraphy; Mark W. Dewey, Syracuse, N. Y., assignor of two-thirds to Emil Laass and Charles H. Duell, same place.

395,614 Printing telegraph; Mark W. Dewey, Syracuse, N. Y., assignor of two-thirds to Emil Laass and Charles H. Duell, same place.

395,622 Dynamo electric machine; John F. Kelly, New York, N. Y., assignor to the United States Electric Lighting Company, same place.

395,667 Electric railway signal; Daniel G. Smith, Pocatello, Idaho, assignor to Reinhardt L. Brown, same place.



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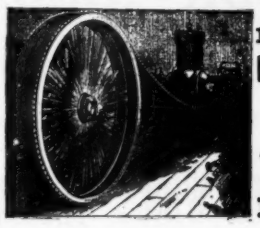

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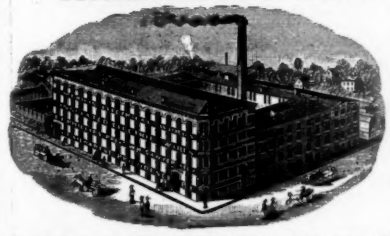

Patent Finished Insulated
ELECTRIC WIRES,
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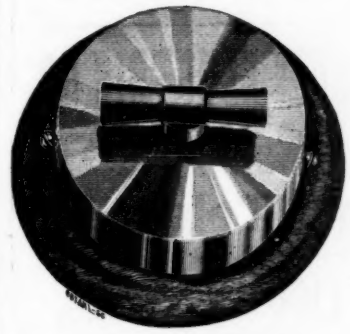

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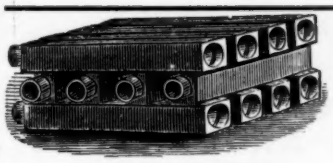

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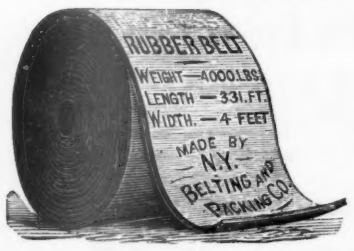

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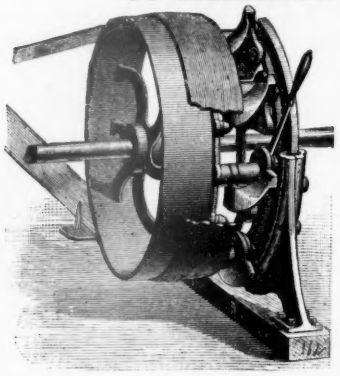

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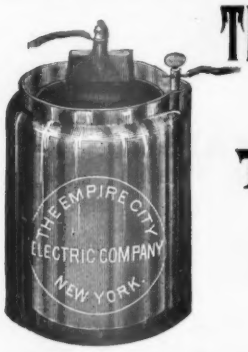

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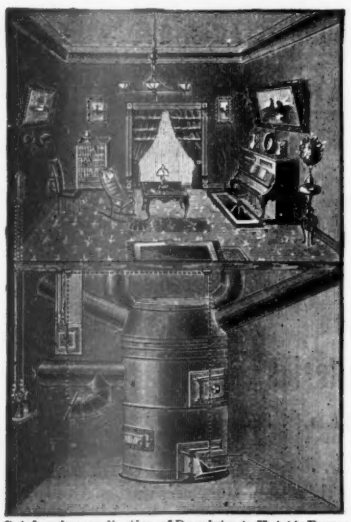

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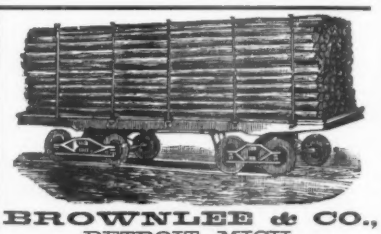

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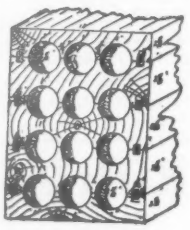

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